THE GAS JOURNAL

JUNE 13, 1934

Vol. 206. 86th Year No. 3708

A REVIEW OF PROCEEDINGS

at the Institution Meeting June 5, 6, and 7

After a lapse of three years the Institution of Gas Engineers once again meet at the Institution of Civil Engineers in London for their Annual Conference. On Tuesday morning last Mr. Tarratt, while appreciating that London is always an attraction, must have been gratified with the splendid attendance—an undoubted tribute to his popularity. There was, of course, a return to the cordial handshakes at the entrance to the dignified building of the Civils in Great George Street, but the Great Hall was packed when the proceedings commenced with a swing at the appointed hour of 10 o'clock.

The Secretary having read the notice convening the meeting, the President called upon him to announce the greetings which had been received from overseas Gas Associations.

Before doing so, Mr. Alexander stated that a telegram had been despatched that morning to the Canadian Gas Association, who at the time were holding their Annual Convention in Montreal. The telegram expressed the cordial greetings of members of the Institution and good wishes for a successful Convention, and it contained the following sentence: "Members who visited Canada in 1933 will drink to the health of their Canadian friends at 21.30 hours on June 6, 1934, at the American Reunion Dinner in London." Then the Secretary announced the receipt of a cable from Mr. Arthur Hewitt, immediate Past-President of the American and Canadian Gas Associations, in which he expressed the hope that he would be able to be with the Institution at the Annual Meeting next June; of letters from the Dutch Gas Association, the Czecho-Slovakian Gas Association, and the German Gas Association; of telegrams from the Swiss Gas Association, signed by MM. A. Dind and H. H. Zollikofer, and from the Norwegian Gas-Works Association. Then there were messages from Herr Fritz Escher, President of the International Gas Union, M. de Lachomette, who attended the National Gas Conference in London in 1931, and from Mr. Bernard Brown, of Santos. Finally—and a happy feature—there were greetings and best wishes to the President from the workmen and staff of the manufacturing, distribution, and bye-products departments of the Newcastle Gas Company.

Mr. Tarratt, saying how pleased they all were to have such messages of goodwill, expressed particular gratitude to friends in Canada and the United States for their kind wishes. It was a happy coincidence that the Canadian Gas Association should be meeting at the same time as they in London were holding their annual conference. The President also said how pleased they were to have with them several members from overseas, to whom he extended a most cordial welcome.

The minutes of the meetings of the Institution in June and November of last year were then confirmed and signed, after which Mr. C. F. Blincoe and Mr. W. W. Atley were appointed scrutineers for the ballots for the election of Officers.

Congratulations to Col. Carr.

On behalf of the members, the President extended congratulations to Col. Carr, on whom the King had conferred the Order of the British Empire, Military Division. A great honour which was reflected to the Institution.

Presentation of Medals.

The President then called upon Mr. R. W. Hunter to come to the platform to be presented with the H. E. Jones London Medal for his paper, "The Coke Oven Plant at Beckton Gas-Works," read at the meeting of the Institution in Liverpool last June. Mr. Hunter, returning thanks, said that like most of the things that emanated from Beckton the paper was the result of team work, and he accepted the reward on behalf of his team.

The Institution Silver Medal, 1933, was awarded to Mr. G. C. Pearson for his paper, "Repairs to Reinforced Concrete—by Cement Gun Method," read at the Autumn General Meeting of the Midland Association of Gas Engineers and Managers in Birmingham last year.

The final award, the Institution Bronze Medal, 1933, was presented to Mr. Philip Richbell, of Croydon, for his paper, "Some Notes on Distribution," read before the London and Southern District Junior Gas Association.

Increased Membership.

The President then moved that the Annual Report for 1933-34 be taken as read—a motion which met with no comment. Once again we can record an increase in Institution membership. At Dec. 31 last the membership, at 1,494, showed an increase of 17 over the corresponding figure for the previous year; and we take it that, by now, the 1,500 mark has been passed. The next goal is 2,000.

As formerly, the bulk of the report is a résumé of what took place at the annual meeting in Liverpool a year ago and at the autumn research meeting last November. An unusual feature is the reference to the visit of the Institution to Canada and the United States of America. In regard to research, attention is called to the fact that the Joint Research Committee has circulated a questionnaire on the formation and occurrence of gum in town gas. This is indeed a time of questionnaires. The Liquor Effluents and Ammonia Sub-Committee is busy with one, while another on the question of meter standardization has been issued by the Meters Committeee. This questionnaire is appended to the Committee's first report—"Standardization of Gas Meters."

The report records that the revised Educational Regulations became fully operative at the commencement of the current educational year and have proved beneficial to all concerned. The number of entries for the 1934 examinations has been maintained, the number of Approved Courses of Instruction has been increased, and the facilities generally have been extended.

It is mentioned that the Council of the Institution, through the Gas Industry Committee and otherwise, continues to co-operate with the British Standards Institution

in the preparation of British Standard Specifications, and that a Glossary of Gas Terms is being prepared. Gas undertakings are recommended to become members of the B.S.I., and thus directly to participate in and benefit from its work.

An item of considerable interest is the resolution that members of Council shall not, during their period of office, sign as proposers application forms for admittance to the Institution or for transference from one class of membership to another. During 1933-34, 88 meetings of Council and Committees were held; and in place of the Executive Committee and the Finance Committee of the Council, a General Purposes Committee, Finance Sub-Committee, and Membership Sub-Committee have been appointed.

Views on a Merger.

At this stage of the proceedings the President rose to deliver his Address—a broad survey of the Gas Industry as it stands to-day. Contrary to what might have been expected, the visit of the Institution of Gas Engineers to America last year has not convinced Mr. Tarratt that the merging of the Institution, National Gas Council, British Commercial Gas Association, and the Society of British Gas Industries into one organization on the lines of the American Gas Association would be advantageous. The four British Gas Organizations, in his opinion, are, like the British Constitution, illogical in theory but extremely effective in practice. The work of our separate organizations, he maintains, would not be rendered more effective by "constitution-mongering," and a remedy for any shortcomings has already been found by the setting up of a Joint Co-Ordinating Committee equally representative of the various bodies. Discussing the proposed new legislation for the Industry, the President expressed regret that the Gas Undertakings Bill of 1934 omits to give effect to the recommendation of the Wrottesley Committee that gas undertakings should be empowered to apply a minimum charge. Also he regrets that multi-part tariffs cannot be made compulsory. His comments on the experience of gas rates at Newcastle are most interesting. Two-part tariffs have met the requirements of the large industries in the district, but it has been found that only at a loss of revenue too great to contemplate could that tariff be modified to make it attractive to a large proportion of domestic consumers. The block system, he says, would involve a great loss of revenue or would be insufficient attraction to the large industrial consumers. It has, therefore, been decided that it is expedient to introduce a separate tariff applying only to domestic consumers. In connection with the Gas Undertakings Bill, Mr. Tarratt also expressed regret concerning the proposal to transfer the duties of the Gas Referees to the Board of Trade.

Amalgamations.

Amalgamation, competition, and research are among the topics considered by the President. While admitting that amalgamation of gas undertakings carries with it many hardships, he maintains that the policy must be pursued whenever the proper opportunity occurs. Not otherwise, however. Mere financial grouping, or the addition of one economic unit to another economic unit is not in the best interests of the Gas Industry, as the exponents of wholesale rationalization have learned. We shall overcome competition only by using to the utmost the machinery and resources of the four national gas organizations, and by adopting fresh methods and developing new uses for gas and bye-products. To quote Mr. Tarratt: "I am optimistic enough to think that, if the Industry realizes immediately the importance of research and technical investigation on a scale hitherto hardly visualized, we may regard the full development of the use of gas as just commencing rather than terminating, as some profess to believe." Also it is essential that we take the long view and remember that most manufacturing concerns are working far below their real capacity, and any substantial improvement in their trade might at once make them profitable concerns.

We call attention to the comments of the President on the lighting load. He insists that we are doing relatjvely nothing in the way of research and technical investigation to keep gas street lighting ahead of electric street lighting in its efficiency and economy. Shall we, he asks, be alive to the position when the load and its attendant publicity have gone elsewhere? If a high-pressure supply of gas is necessary and high-pressure mains cannot be widely laid, the technique of gas street lighting must be developed in respect of low-pressure supply.

Referring to the research work of the Institution and Leeds University, Mr. Tarratt mentions that further experiments are to be made with gas containing diminishing sulphur contents—a pressing question discussed by the authors of the paper on benzole recovery and refining which followed immediately upon the President's Address.

Speaking of the Institution, Mr. Tarratt rightly placed great value on the Education Scheme, which has done so much to enhance the quality of Institution membership. "In ten years," he remarked, "the number of examination candidates has increased from 60 to 417, and we see a steady improvement in the type of applicant who is making good his claim for promotion and general advancement in our ranks. It is imperative that admission to membership should be difficult, as a high standard is far more important than a large membership."

Appreciation.

A vote of thanks to the President for his Address was proposed by Mr. J. W. McLusky and seconded by Mr. R. Robertson. Mr. McLusky said they had heard that day an address of outstanding merit, without frills or flights of fancy and packed with common sense. The President had told them that he was an engineer and inferred that they were not to look for academic brilliance, but, said Mr. McLusky, "I submit that the address reveals the mind of a sagacious, practical, and clear thinking administrator." Mr. Robertson observed that in eulogizing the President and his Address no strain was imposed upon the veracity of either the proposer or the seconder; their difficulty was simply to do justice to their subject.

Mr. McLusky paid tribute to the Chairman and Directors of the Newcastle Gas Company for the inspiration and encouragement which they have given the Institution in providing no fewer than three Presidents during the past twenty-six years.

Benzole Recovery.

It was appropriate that after the Address of the President, two members of his staff should present a joint paper. The contribution by Messrs. Wikner and Richardson, which brought Tuesday morning's session to a close, contains a vast amount of valuable information on the subject of benzole recovery and refining, with, naturally, particular reference to the practice of the Newcastle-upon-Tyne and Gateshead Gas Company. After a brief introduction the authors compare the extraction efficiency of gas oil with that of creosote, showing that gas oil may be used for long periods in the circulating system without the necessity for renewal and without the formation of sludges or emulsions. The effect of benzole recovery upon the calorific value and naphthalene content of gas is then discussed. With a recovery of 2·46 gallons per ton of coal carbonized, the average reduction in calorific value is 27 B.Th.U. per c.ft.

As to naphthalene removal it has been found that, while it is possible to extract the bulk of the naphthalene from the gas during the process of scrubbing for benzole, complete elimination of this compound is never effected owing to the relatively high temperature of the oil (22° C.-28° C.), and it is necessary to remove the residual 1·6 to 2·0 grains per 100 c.ft. by treatment with fresh gas oil in a separate rotary scrubber. The spent oil from the latter—approximately 30 gallons per million c.ft. of gas—is added to the wash oil system of the benzole plant to compensate for wastage. In this way a gas perfectly free from naphthalene vapour is distributed throughout the year. It is pointed out that the efficiency of naphthalene recovery does not depend upon the length of time the oil remains in circulation, and the amount extracted per 100 c.ft. is approximately the same whether the wash oil employed is fresh or has been in use for several months and consists principally of constituents distilling above 300° C.

Removing Sulphur Compounds.

What to us is one of the most interesting sections of the paper is concerned with sulphur removal. There can be no doubt that one of the most beneficial results attending upon benzole recovery is the reduction in sulphur content of the gas which takes place due to the extraction from the gas by wash oil of a portion of the carbon disulphide, thiophene, and mercaptans. Prior to the commencement of the process at North Shields the sulphur present in the purified coal gas averaged 22 grains per 100 c.ft., but oil washing immediately brought about a reduction to 12 grains. The reduction in the sulphur at North Shields is of the order of 45%, or 10·1 grains per 100 c.ft., with an oil-gas ratio of 9 gallons per 1,000 c.ft., of which figure carbon disulphide recovered in the crude benzole accounts for 5·8 grains; the more or less complete extraction of thiophene together with a small quantity of mercaptans is responsible for the remaining 4·3 grains.

It would seem that the extraction of the remaining 60% of sulphur, present almost entirely in the form of carbon

FRANK P. TARRATT, M.Inst.C.E.

Mr. Tarratt was trained under the late Mr. Alfred Colson, M.Inst.C.E., at Leicester, and for several years acted as one of his principal Assistants. He was appointed Engineer and Manager to the Darlington Corporation Gas Department in 1898, and during the time he was in control he built an entirely new works on a site adjoining the old gas-works. He was appointed Chief Engineer of the Newcastle-upon-Tyne and Gateshead Gas Company in 1921, and since he has been with the Company, the Walker and Wallsend, the Chester-le-Street, and the Tynemouth Undertakings have been taken over. He is a member of the Institution of Civil Engineers, and holds various positions in connection with the National Joint Industrial Gas Council, the Federation of Gas Employers, the National Gas Council, and the North of England Gas Managers' Association. Mr. Tarratt led the Delegation of Gas Engineers and other representatives of the Gas Industry to Canada and the United States of America to attend their Gas Conventions in 1933.

disulphide, might be conveniently carried out in some form of active carbon filter, seeing that the gas to be treated would contain little benzole vapour and no naphthalene. If some such adsorbent could economically be adopted a sulphur-free gas would result, the advantages of which to the Gas Industry it is unnecessary to emphasize. It must be appreciated, however, that reductions in sulphur content to the extent of 40% can only be looked for when the volume of wash oil employed is sufficient to recover up to 90% of the benzole hydrocarbons. If it is desired to extract a portion only of these, then a corresponding decrease in the quantity of sulphur bearing compounds removed from the gas will take place. At the same time, partial stripping implying a low oil-gas ratio has the effect of leaving benzene in the gas so that the crude benzole recovered will show a higher proportion of toluene, xylenes, paraffins, and unsaturated hydrocarbons. And, of course, the presence of paraffins in crude benzole is not desirable, while abnormally high proportions of unsaturated hydrocarbons spell heavy loss when the benzole is washed with sulphuric acid, though with the introduction of the inhibitor process this is not of such moment except that the heavier unsaturated hydrocarbons present difficulties in inhibition, and a partial treatment with acid is sometimes necessary.

Costs and the Methanol-Soda Process.

The section on debenzolizing plant includes consideration of steam consumption and oil cooling. The importance of the latter and the difficulty experienced in controlling the temperature of the cooled oil are emphasized. The authors give the costs of crude benzole recovery at the North Shields Station as typical of what may be obtained in an undertaking of similar capacity under ordinary working conditions. We cannot go into details of this here, but we give two figures. The total operating costs work out at 3·96d. per gallon of benzole extracted, and the excess of receipts over expenditure amounts to 7·04d. per gallon. The authors say that since the thermal content per gallon of spirit actually derived from the gas is 1·48d. the price realized per therm of benzole vapour extracted is 7·4d.

The factors governing the paraffins, sulphur, and unsaturated hydrocarbon content of benzole produced from coal gas are considered, and the effects of the adoption of the full charge in horizontal retorts upon the value of crude benzole is discussed.

The last two sections of the paper refer to the ordinary acid-washing process formerly in use at the St. Anthony's Bye-Product Works of the Newcastle and Gateshead Gas Company, together with a short description of the fractionating plant. Experience gained by the adoption of the inhibitor process is then related, together with a short account of the consequent advantages. The drawback of this process—namely, that it fails to remove excess sulphur from the benzole—is mentioned, and a description of experimental work is given which explains the known difficulty of removing carbon disulphide by fractional distillation. A detailed account is given of the adoption of the methanol-soda process for the removal of carbon disulphide from benzole by chemical means.

Experience with Spindle Oil.

Colonel Carr, who opened the discussion, compared his experience of benzole recovery at Stretford with that described by the authors, explaining that the results of his

use of gas oil did not tally with those at Newcastle. With gas oil at Stretford all went well for the first three months, during which period wash oil losses amounted to 1 gallon per 26 gallons of benzole. Then, however, trouble started with heavy sludge deposits and the formation of oil-water emulsions. The trouble was of such a nature that Colonel Carr decided to substitute gas oil by spindle oil, and after six months' use of the latter he has had none of the difficulties associated with the employment of gas oil. The cost of spindle oil is about twice that of gas oil. On the other hand, only one-third the quantity of make-up oil is required compared with the make-up oil when gas oil is used. Extraction tests have shown spindle oil to be as efficient as gas oil, so it appears that the higher benzole yield when using the latter is due to gas oil fronts being

S. W. A. WIKNER.

Mr. Wikner was educated at the Hull Municipal Technical College. In 1899, he entered the Hull Works of Messrs. Major & Co., Ltd., Tar Distillers, as Works Chemist, being appointed Works Manager in 1907. From 1911 to 1919, he was Works Manager of the Nechells (Birmingham) Tar Distillation Works, at that time owned by Messrs. Josiah Hardman, Ltd. In 1919, he was appointed to his present position of Manager of the St. Anthony's Bye-Products Works of the Newcastle-upon-Tyne and Gateshead Gas Company. Mr. Wikner was elected a Fellow of the Institute of Chemistry in January, 1924.

carried into the benzole fraction. At Stretford the total cost of rectified spirit amounts to 6·87d. per gallon, which leaves a useful net profit which eventually finds its way into the consumers' pockets.

Confirmation that the modern practice of adding cracked residues to gas oil by the petroleum distillers has an adverse effect on benzole washing was forthcoming from Mr. Thorman. Between 1926 and 1929, using straight distilled gas oil at the Southall Works, Gas Light and Coke Company, sludging troubles were negligible, and except for make-up, no oil was changed. During the last five years oil containing cracked residues has been used, and sludging has been rapid. Mr. Thorman emphasized the great importance of the temperature of wash oil in benzole recovery. Outlay on cooling plant is often better repaid than provision of additonal heat exchangers. After eighteen months' work to the new specification of the National Benzole Company, Mr. Thorman believes that the last word has yet to be said about the relative methods of inhibiting and of strong acid washing. Some types of crude benzole, especially some vertical crudes, may still be advantageously rectified by the older method, especially when no further treatment for sulphur removal other than that of removing thiophene is needed. Concluding his remarks, Mr. Thorman gave the reason why he had not adopted methanol soda process.

The Economic Aspect.

The next speaker was Mr. Firth, of Leeds, and we have never heard a speech delivered with greater rapidity. At Leeds, creosote is employed for benzole recovery with every satisfaction, and, as Mr. Firth pointed out, creosote is a gas-works product. Naphthalene presents a problem, of course, where creosote is employed as a washing medium, and Mr. Firth described how the difficulty is overcome at his works. Benzole recovery, he remarked, is now generally admitted to be a paying proposition, particularly when compared with the results from a similar capital outlay used in supplying new housing estates with gas. Increased revenue to an undertaking from a " new consumer " taking the equivalent of 5% of the total thermal output is a point which cannot be over-emphasized; and where a benzole plant is installed the difficulty of being able to show a saving in works expenses when the plant is shut down for a period shows how little these are increased when benzole recovery is adopted. The inhibitor process and the methanol soda process are in operation at Leeds, and Mr. Firth gave an account of the procedure of working the latter process—a practice quite different from that adopted at Newcastle. He put forward the suggestion that co-operation between a few works with one works undertaking the recovery of methanol from the spent material has much to commend it.

Remarking that to-day there must be between 120 and 150 benzole plants in operation, Dr. Lessing urged that now is the time for technical improvements to achieve what was begun in a relatively coarse way of dealing with the matter to bring it to a higher degree of perfection, in which respect he paid a deserved tribute to the work of Messrs. Wikner and Richardson. Having emphasized the important part played by the ratio of ring packing to still column in fractionation, Dr. Lessing referred to the question of the sludging of the wash oil. In his view the various oils available for benzole recovery should be examined on comparative lines in the laboratory in the first instance; and in his opinion the subject is one which should claim the attention of the Research Committee of the Institution.

The last speaker in the discussion was Mr. Holton, of Manchester, who commented on the influence of sulphur content of the wash oil on benzole recovery. It is because of this influence of sulphur that he is changing from gas oil to spindle oil at one of his works. In regard to the cost of benzole recovery, Mr. Holton pointed out that the authors charged a certain amount for coal. He believes, however, that it is best to arrive at a fair price for the therm and then charge the process up with so much per therm, rather than simply to give it its coal equivalent, which takes no account of capital costs. He also believes there is a great future for crude benzole, with the one proviso that we can get rid of its nasty smell.

B. RICHARDSON.

Mr. Richardson was educated at Archbishop Holgate's Grammar School, York. In 1918, he was appointed Senior Chemist under Dr. G. Weyman, of the Newcastle-upon-Tyne and Gateshead Gas Company, and a year later he became Chief Chemist to the Tynemouth Gas Company. Mr. Richardson was appointed Works Superintendent of the Newcastle and Gateshead Company in 1927, and has been Lecturer in Gas Engineering and Chemistry of Gas Manufacture at the Rutherford Technical College, Newcastle-upon-Tyne, since 1927.

Town Gas in the Steel Industry.

The first paper on Tuesday afternoon was by Dr. Fells, Chief of the Fuel Research Department of the Sheffield Gas Company, on the use of town gas in the steel industry. At the outset the author remarks with every justification, that Mr. Ralph Halkett, in giving permission for the publication of information appertaining to the use of town gas in the steel industry, has made it possible to add considerably to the knowledge of gas utilization in one of our most important industries. His appreciation of the great possibilities of the use of gas in the major Sheffield industry, and his efforts to assist the steel manufacturers, not only by making available large quantities of gas at thermally competitive prices, but also in giving free the services of

THE 1933 INSTITUTION MEDALLISTS

H. E. Jones London Medal - - - Mr. R. W. Hunter
Silver Medal - - - - - - - - Mr. G. C. Pearson
Bronze Medal - - - - - - - - Mr. P. Richbell

The Presentation of the Medals is referred to in our Review.

R. W. HUNTER.

Mr. R. W. Hunter was educated in Chester, commencing his career in 1897 as pupil of his father, the late Robert Hunter, Engineer and Manager of the Chester United Gas Company, and of his successor, Mr. J. C Belton. He studied chemistry and mechanical engineering, &c., at the Chester Technical School, and later, at the Polytechnic, London. He took 1st Class Honours (City and Guilds Institute), in gas manufacture in 1904. In 1902 he entered the service of the Gas Light and Coke Company at their Kensal Green Works, and was transferred to Beckton in 1903, where he was a Senior Assistant Engineer in charge of a section of that Works on the outbreak of war Mr. Hunter held a commission in the 12th London Regiment "Rangers" (which is mainly composed of Gas Light and Coke Company personnel, with the Governor of the Company as Hon. Colonel), and proceeded to France with the 1st Battalion, in 1914. After serving throughout the war until invalided out in 1918, he returned to Beckton, where he has since remained, with the exception of a period of two years as Deputy Engineer at Bromley by-bow. After a period as Senior Officer in charge of the Works during the serious illness of Mr. W. B. Leech, on the transfer of the latter to the Chief Office of the Company, Mr. Hunter was appointed Station Engineer at Beckton in 1928. He joined the old Gas Institute as an Associate Member in 1900, and is now a member of the Institution of Gas Engineers, of the Institute of Fuel, and of the Southern Association of Gas Engineers and Managers.

G. C. PEARSON.

Mr. G. C. Pearson commenced his career in the Industry with the Birmingham Gas Department in 1901, under Dr. H. G. Colman. From 1908 to 1915 he was Superintendent of the Coal Testing Works, during which period he was engaged in investigating the comparative advantages of the different systems of retorts, liquid purification coal valuation, &c., under Dr. W. B. Davidson and Dr. E. W. Smith. In 1915, Mr. Pearson was appointed Works Engineer at the Windsor Street Works of the Birmingham Gas Department, under Mr. John Foster; and in 1919 he became Engineer at the same works, in which capacity he has since served.

P. RICHBELL.

Mr. P. Richbell was educated at Colfe's Grammar School, Blackheath. In 1907, he was articled, as a pupil, to Dr. C. Carpenter at the South Metropolitan Gas Company. In 1913, on the completion of his training, he was appointed Assistant to Mr. H. C. Head, Engineer and General Manager of the Winchester Water and Gas Company. In 1913 he became Assistant to Mr. W. H. Johns, the Chief Engineer of the Sheffield Gas Company, and in 1920 he was appointed Assistant to Mr. W. J Sandeman, Distribution Engineer and Sales Manager of the Croydon Gas Company, which Undertaking he is at present serving.

practical and technically trained men, have taken an important part in the new era of recovery in Sheffield.

Persistent practical demonstration, and investigation of steel manufacturers' individual problems carried out by the staff of the Sheffield Gas Company's Industrial and Research Departments, augmented by the designing of new forms of furnace and methods of gas application, have resulted in a greater appreciation of the economic possibilities of town gas as a fuel in the steel industry. The rapidly increasing demand for gas for all steel heating purposes, especially among the larger steel firms, confirms that gas is undoubtedly becoming the preferred fuel.

Dr. Fells' paper indicates the type of development which has taken place of recent years. Not only has the thermal efficiency of gas-fired furnaces been improved, but much greater use is being made of the manufacturing savings incidental to its use. In fact, the savings of costly operations subsequent to heating made possible by the use of controlled systems of combustion, and by atmosphere control, are in many instances considered to be more important even than high thermal efficiency. The metal industries are probably unique in this respect, and it is suggested that investigation into the practical application of the wealth of knowledge already in existence on the action of gases on metals would be amply justified by the increase in gas consumption which would follow. It may be said, in fact, that whenever grinding or acid pickling of ferrous and non-ferrous metals is carried out to remove surface damage due to heating, the full use of gas as an industrial agent is not being made.

The paper is divided into two parts. In the first, the subject is introduced by a description of the functions of

Dr. H. A. FELLS.

After he had attended the Brunts School, Mansfield, and Nottingham University, Dr. Fells graduated at London University in 1923, and carried out Post-Graduate Research until 1927. He was appointed to the Safety in Mines Research Board, working at Leeds and Sheffield, and to the Sheffield and District Smoke Abatement Research Committee, specializing in industrial smoke in the steel trade. Dr. Fells is at present with the Sheffield Gas Company as Chief of the Fuel Research Department.

heat in the manufacture of steel articles, indicating the two main purposes of heating—re-heating and heat treatment. Reference is made to the various types of fuel which have been, and still are, used, and the survey given indicates the variety of applications of heat in the steel trade, and, in a general manner, the type of competition to be met. This survey is followed by details of the requirements demanded of a fuel for modern practice in steel heating, and the author shows how town gas is capable of meeting all these requirements. A reiteration of certain valuable features of town gas as an industrial fuel is given, and is followed by a consideration of methods used in everyday practice for improving the thermal efficiency of gas-fired furnaces. The description of the principles and desired features of gas-fired furnaces is amplified by detailed accounts of different types of heating operations, and the type of furnaces used in billet heating for rolling, billet heating for forging and drop stamping, sheet heating, annealing, and heat treatment for hardening.

Control of Furnace Conditions.

The second part of the paper is concerned with the control of furnace conditions. It is pointed out that the increasingly exact requirements of the steel industry today demand much closer attention to furnace control than has been deemed necessary in the past. Following an account of the necessity for use of accurate temperatures in steel treatment, considerable attention is given to a technical discussion of the properties of furnace atmospheres, for the author feels—and we agree with him—that the full significance of the action of products of combustion on steels has not been appreciated in the past. For this reason we think that the matter should be emphasized here.

The question is, What type of atmosphere can be used which will neither scale nor decarburize steel at any of the temperatures ranging from that used for annealing purposes to that employed for hardening high-speed and alloy steels? In a neutral atmosphere containing water vapour carbon dioxide, and nitrogen, the first two constituents will cause scaling and decarburization. The addition of a small amount of unburned gas, while limiting the amount of scale slightly, increases the amount of decarburization. The tendency to form scale would be enormously reduced if the water vapour were removed. Now it is not difficult to cool the mixture sufficiently to have a percentage of water vapour as low as 1·8. Such a mixture of gases in a muffle will have a very much reduced tendency to form scale, or even to decarburize, but at high temperatures such as 1,300° C. this mixture will form a certain amount of scale, due to the carbon dioxide and to the very small amount of water vapour present. But to prevent these two gases having any scaling action whatever, and furthermore to prevent them from removing carbon from the surface of steel, requires but a very small amount of unburned gas in addition. Prof. Cobb has shown that, to render an ordinary neutral atmosphere non-scaling, it required the addition of very large amounts of unburned gas, owing principally to the high water vapour content of such an atmosphere. When the water vapour is first removed by cooling, however, the amount of unburned gas required is exceedingly small, and very fortunately indeed in practice the amount required *decreases* as the temperature of the operation increases.

This, Dr. Fells emphasizes, is a particularly important point. By the removal of water vapour from neutral products of combustion, *followed* by the addition of unburned gas, the chemical reactions between the gases at elevated temperatures give ratios of the resulting gases that are in equilibrium not only with the iron in the steel, but also with the carbon and complex carbides. Variation of the proportion of cooled products of combustion to unburned gas added enables such mixtures of gases to be obtained in a furnace as are in similar equilibrium for most steel compositions, at any temperature being used. At very high temperatures, or for prolonged heating, no system of practical combustion of town gas is capable, of itself, of preventing both scaling and decarburization. A practical example will indicate what is meant. One process advocated for prevention of surface damage to high speed steel at 1,300° C. recommends the use of equal parts of gas and air. The ratio of the resulting products of reaction, with a normal town gas, are such that scaling is prevented. But the amounts of hydrogen and of water vapour present are in such excess of the carbon monoxide present that decarburization is unavoidable, even for short heating periods.

By the removal of water vapour from products of complete combustion, and the subsequent addition of raw gas, the chemistry of the reactions taking place is similar to that which has just been described, but the ultimate ratios of the gases produced are very different. At high temperatures the amount of carbon monoxide produced is much in excess of the amount of hydrogen present; the amount of water vapour present is very small, and the amount of carbon dioxide present is also small. The result is that the predominating gases capable of chemical reaction which are present are carbon monoxide and hydrogen. Both these gases prevent scaling. Carbon monoxide is a carburizing gas, and hydrogen is a decarburizing gas. It is natural then that some suitable ratio of the two exists which will be in equilibrium with the carbon in steel, and which will neither decarburize nor carburize. A further point which assists this particular process is that the partial pressure of the active gases present is much lower than the partial pressure of the gases produced by controlled systems of combustion or reaction of gas and air.

This cooling of waste gases and subsequent addition of unburned gas constitutes the basis of one of the most recent systems of complete atmosphere control for steels, especially at high temperatures.

The technical details of atmosphere control are followed by accounts of processes in use incorporating various successful and practical systems of atmosphere control, using town gas, and mention is made of other methods of obtaining control of furnace chamber conditions.

Tables showing the type of results obtained in practice using town gas as fuel are given, and there is a table of

comparative costs of town gas and oil used for heat treatment of forgings and drop stampings. Under works conditions, it is stated, the cost of heating by town gas is appreciably less than heating by oil, with gas at 1s. per 1,000 c.ft. and oil at 58s. 6d. a ton. Further tables and graphs show the scaling and decarburizing action of various mixtures of gases as found in everyday practice.

A Coke Oven Gas Problem.

Discussion on Dr. Fells' paper was, as we anticipated, both lengthy and valuable. It was appropriate that the first speaker should be Dr. Walter, of Birmingham, who has done such sterling pioneer work in the application of town gas to industry. Dr. Walter's contribution was really in the nature of a series of questions to the author, and these and several questions put by other speakers were of such a nature that Dr. Fells intends to reply to them in writing. One of the queries raised by Dr. Walter was whether the author had experienced difficulty in using high-grade gas in open hearth furnaces, because of its high hydrogen content, and consequently the large quantity of water vapour in the products of combustion. For this reason he thinks that high-grade gases have not been used extensively in steel manufacture. Dr. Walter also asked the author whether he had had any trouble due to disintegration of regenerator brickwork where forging furnaces are, as is usually the case, positioned close to the hammers. He himself has found difficulty with regenerative settings due to the vibration effect caused by the hammers.

The next speaker, Mr. Greenfield, who is Vice-President of the Coke Oven Managers' Association, and who is naturally extremely interested in extending the use of coke oven gas both for domestic and perhaps more particularly for industrial purposes, brought out many important points. The first thing he emphasized is that a modern coke oven plant is reliable; it is designed to produce gas constantly and to produce gas of a high calorific value. He welcomes the paper especially because it helps in understanding the problems of those who are to a large extent the ultimate consumers of coke oven gas, and here, he maintains, just as every gas worker ought to be a salesman of gas, so everyone associated with coke oven practice should be a salesman of coke oven gas. A matter of first-rate importance to the Gas Industry, which is, or should be, doing all possible to utilize coke oven gas, is that coke oven plant is not as flexible as gas-works plant. Suppose, for example, it becomes possible to supply an industrialist on a large scale with coke oven gas, it is to be remembered that in all probability the industrialist's plant will be closed down at the week-ends, with, consequently, an enormous falling-off in gas demand. How is either the gas undertaking or the coke oven in partnership with it to deal with this problem?

A Specialist Corps Needed.

Following this, Prof. Cobb suggested that the paper shows how the gas man can secure a footing with the metallurgist, for the benefit of both, if he can make his contribution to the questions that arise in such processes as the furnacing of steel. He hopes the same enlightened practice will become general. It is necessary to render available the technical skill and understanding of a man well trained in combustion engineering and chemistry, who has applied his thought to the particular problem before him. For this purpose, considerable mental elasticity and adaptability are required, in addition to a knowledge of the science of gas engineering. Prof. Cobb believes that a corps of such men is required in the Gas Industry if the applications of gas are to be much further advanced. It does not exist, but requires to be created, and he is certain that it can be created if young men of scientific training are given a fair opportunity, and if they are not expected to be ready-made experts before they have had the necessary experience in their work.

Discussing scaling, Prof. Cobb remarked that the presence of sulphur dioxide has quite a marked effect in increasing scaling. The scale produced with an amount of sulphur dioxide (0·2%) corresponding with an average unpurified coal gas or coal is, at 1,000° C., roughly one and a half times as much as that produced from a purified coal gas containing 25 grains of sulphur per 100 c.ft. "I will not say more at the present time about these results of experiments," concluded Prof. Cobb, "but they are of a very interesting character. They may have an important bearing on the economic position of a purified coal gas in furnace work as compared with other fuels, and on the interesting question of how far it is desirable to distribute coal gas (including coke oven gas) for industrial purposes in an unpurified condition."

An important contribution to the discussion—and a contribution which was well received—was by Mr. J. E. White, of Newcastle, who said that there is no doubt that the process under consideration decides to a large extent the nature of the furnace to be used. His experience is that where frequent furnace door openings are involved, there is little if anything to be gained by elaborate heat recovery systems. If, however, the process is of a continuous nature such as the annealing of large steel castings or the carburizing of mechanical components, then unquestionably some form of heat recovery should be used. The use of such heat recovery will bring the price of gas to within the possible range of the majority of British gas undertakings. There is, for example, no reason why the price charged for gas for the process of carburizing and reheating after carburizing should be less than 4d. or 5d. per therm.

The possibilities open to the Gas Industry generally at a normal price of say 6d.-8d. per therm, he remarked, are considerable, especially in the commercial uses of gas, and there is a very considerable field for development where gas is available at approximately 4d. per therm. But in really cheap gas—between 2d. and 2½d. per therm—there are possibilities which are so great that any ordinary commercial firm having such possibilities would consider itself very favourably placed, and, fortunately, those industries to which gas is competitively attracted at 2d. to 2½d. per therm are usually situated in areas where coke oven gas is available.

Anticipatory Costing.

"I venture to suggest that the Gas Industry should carefully consider the question of the motor car industry," remarked Mr. White. "Anticipatory costing has enabled men like Sir Herbert Austin and Lord Nuffield to offer to the public cars double the value and half the cost of the models they were offering ten years ago. I believe that when the Gas Industry has arrived at a fuller appreciation of the relationship between the true economic value of gas fuel and the industries of the district, it can, by the same costing considerations, do the same big business."

Colonel Carr was in complete agreement with Mr. White on the question of anticipatory costing. In his own undertaking at Stretford he has gained large increases accompanied by a good revenue return by following the actual costs of supply in making contracts, rather than taking average costs; and in this connection Colonel Carr suggested that rather than talk down costs too low, the aim should be to get the best price for gas for a particular purpose, bearing in mind, of course, the intensity of competition. And he stressed that actual fuel costs in a particular process are by no means the true comparison of saving. One must take into account such things as reduced scale, spoilage, and machining, and greater output and flexibility.

It was generally agreed at the meeting that Dr. Fells' paper is one of the most valuable contributions on the subject of industrial gas utilization ever offered to the Industry.

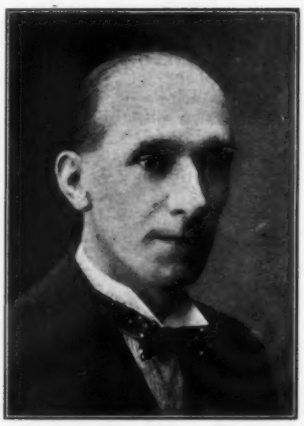
Making Solid Smokeless Fuel.

The final paper on Tuesday afternoon was by Eng.-Capt. Shaw and Dr. King, and concerns recent experiments at the Fuel Research Station upon the production of solid smokeless fuel. The first part deals with the evolution of a firebrick retort for the production of low-temperature coke. The flue temperatures in this retort are high, 1,050°-1,150° C. at the top, decreasing to about 700° C. at the bottom, but those of the inner surface of the brickwork do not rise appreciably above 700° C. In an introduction to the paper the authors epitomize the history of the investigations at the Fuel Research Station on the production of a smokeless fuel "which would be as satisfactory for domestic purposes as the best household coal." The problem, commenced in 1919, was essentially the production of a fuel which would show free-burning properties in the common types of open grate or kitchener. After a series of experiments with steel and cast-iron retorts of different types, comparative success was achieved with a vertical cast-iron retort arranged for continuous operation. Further experiments with this retort indicated, however, that it was impossible to be certain of sufficiently long life with the type of cast iron then available to ensure that the process could have commercial possibilities. In 1930, therefore, experiments on this retort were abandoned, and a retort of similar design but constructed of firebrick was built to determine whether the necessary heat transfer could be achieved through brickwork. It had already been ascertained by preliminary experiments in a Glover-West retort at a flue temperature of 850° C. that the use of brickwork held distinct possibilities.

After some experiments with this retort sufficient information was obtained to construct a new setting of two narrow brick retorts. This setting, state the authors, is giving satisfactory performance in experimental work from the points of view of costs, output, and quality of product.

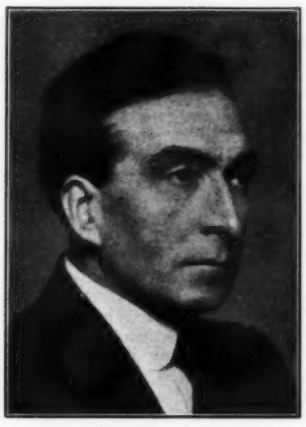
A large number of different types of coal have been

SOME OF THE INSTITUTION NEW MEMBERS



G. R. BULLWINKLE.

Mr. G. R. Bullwinkle was educated in engineering at the East London Technical College. He was later apprenticed to Messrs. J. Richmond & Co., Ltd., of London. In 1908 he joined the staff of the Commercial Gas Company as Assistant District Engineer. After service in France he was demobilized in 1919 and returned to the Commercial Gas Company, who transferred him to the Works Department as Engineering Assistant at Stepney. In 1926 he was appointed Assistant Works Engineer at Poplar Works, and three years later Works Engineer at Wapping. Mr. Bullwinkle was elected a Graduate of the Institution of Mechanical Engineers in 1907 and an Associate Member of the same body in 1914.



W. T. GARDNER.

In 1904 Mr. W. T. Gardner commenced his training in Gas Engineering with the Bournemouth Gas and Water Company, under Col. H. W. Woodall and the late Sir Arthur Duckham. He subsequently joined the Woodall-Duckham Company, and was for a period Engineer in charge of the operation of Woodall-Duckham carbonizing plants. Later he became a Director of the Company. During the past ten years he has been a member of the Refractory Materials Committee of the Institution of Gas Engineers. Mr. Gardner is also a Fellow of the Chemical Society and a member of the Institution of Chemical Engineers.

A. T. HARRIS.

Mr. A. T. Harris served articles under his father, the late Mr. J. A. Harris, Engineer, Manager, and Secretary of the Great Wigston Gas Company. In 1903 he was appointed Manager to the Sileby Gas Company, and became Manager to the Rothwell U.D.C. Gas-Works three years later. In 1916 Mr. Harris was appointed Manager to the Maryport U.D.C. Gas-Works, and in 1927 he returned to Great Wigston as Engineer, Manager, and Secretary.

A. W. J. HARRIS.

Mr. A. W. J. Harris was educated at Highbury County School and University College, London. He obtained his B.Sc. in 1922, with Honours in Chemistry, and six years later his B.Sc. in Engineering. In 1933 he gained a First-Class Diploma in Gas Engineering (Manufacture). Mr. Harris entered the service of the Tottenham and District Gas Company in 1921, where he is now Technical Assistant.

F. O. HAWES.

Mr. F. O. Hawes, having matriculated in 1916 and, two years later, passed his Intermediate B.Sc., commenced as Laboratory Assistant with the Tottenham and District Gas Company, and is now Technical Assistant with the same Company. In 1926 he was admitted to Associate Membership of the Institution of Chemical Engineers, being the first to enter that Institution by an examination.

ELECTED AT THE JUNE MEETING

P. R. HUGGETT.

Mr. P. R. Huggett served the first part of his apprenticeship under his father, who was Manager of the Edenbridge Gas Company. In 1913 he went to the Tunbridge Wells Gas Company, under the late Mr. Andrew Dougall, and continued under Mr. L. J. Langford until 1919, when he was appointed to the Brightlingsea Gas and Coke Company, of which he is now Engineer, Manager, and Secretary.

J. S. JEFFREY.

Mr. J. S. Jeffrey was educated at Dulwich College, and received his early training under the late Mr. W. L. Ramsden, General Manager of Edward Cockey & Sons, of Frome. Later he served as a draughtsman with Messrs. Parkinson & Cowan, and, in 1912, he entered the drawing office of the Woodall-Duckham Company, having been in their service, as an engineer, ever since. Mr. Jeffrey was appointed a Director of the Company in 1925.

R. MILLEN.

Mr. R. Millen commenced his career as a premium apprentice with the Whitwood Chemical Company, Normanton. He studied Gas Engineering and Chemistry at Wakefield Technical College, and in 1911 he was appointed Assistant Chemist at the Dawsholm Works of the Glasgow Corporation Gas Department. After service in France he was appointed Technical Assistant at the Provan Works, and in 1932 became Manager of the same works.

A. SUTHERLAND.

Mr. A. Sutherland received his training as a practical engineer with Messrs. G. & J. Weir, Ltd., of Glasgow. He studied engineering at the Royal Technical College, Glasgow. As an Engineering Assistant to the Glasgow Corporation Gas Department, with whom he has been for 19 years, he has gained wide and varied experience.

M. T. THOMPSON.

Mr. M. T. Thompson was born at Kendal, where his father was Engineer and Manager of the Gas and Water Company. He was educated at Kendal School and, at the age of sixteen, joined the firm of Drakes, Ltd. He later became representative Engineer for the Company in Canada and Australia. In 1920, he was appointed Joint-General-Manager of Drakes, Ltd., and was elected a Director in 1926. Mr. Thompson acted as Chairman of Section I. of the Society of British Gas Industries during the illness of the late Mr. Broadhead, and continued until the conclusion of Mr. Broadhead's term of office. He has specialized in carbonization, and was largely responsible for the development of Drakes' vertical retorts.

carbonized during a period of two years ended June, 1934, with the object of collecting information regarding coals and of ascertaining the probable life of a commercial setting in order that approximate costs could be calculated. Since the setting has now completed two years' service it is most opportune that the details of the experimental

CAPT. J. FRASER SHAW, R.N. (Ret.).

Capt. Shaw was educated at King William College, Isle of Man. At the age of 15 he entered the Royal Naval Engineering College, at Keyham, and was appointed Probationary Assistant Engineer in the Royal Navy five years later. In 1918 he was lent from the Admiralty as Assistant Controller to the Mineral Oil Production Department of the Ministry of Munitions and in 1919 to the Department of Scientific and Industrial Research as Chief Engineer of the Fuel Research Station. Having served in various ranks in the engineering branch of the Royal Navy, Capt. Shaw retired as Engineer Commander in 1922, and was appointed Chief Engineer under the Department of Scientific and Industrial Research. A year later he was promoted Engineer Captain on the Retired List.

work which has been completed to date should be made public.

Experiments are described in the paper which show that the retort can be made to operate satisfactorily on all types and sizes of coal, from non-caking nuts to strongly-caking slacks. The best working conditions are obtained with sized medium-caking coals at throughputs of about 8 tons per retort per day. The variations in working conditions, yields of products, and properties of the smokeless fuels are described in terms of the type and size of coal carbonized.

During the latter part of this work parallel experiments have been carried out upon the carbonization of static charges in order that information could be obtained as to the advantages to be gained by the blending of different types of coal. For this purpose use was made of a setting of two Woodall-Duckham chamber ovens completed at the Fuel Research Station during 1931. In the experiments detailed in the paper the reports have been operated at what may be described as intermediate temperatures in order to produce cokes sufficiently combustible to burn freely in open grates of the common domestic type. With flue temperatures of 650°-850° C., it is stated that static charges can be carbonized to give satisfactory smokeless fuel for the domestic open fire. With suitable blends the fuel is almost as combustible as that produced in the narrow brick retorts. "The retort fuel is more readily ignited, burns up more quickly, and reaches a higher rate of radiation than the oven fuel. The latter is, however, sufficiently free-burning for general use, and its slower rate of combustion may even be, in certain circumstances, a definite advantage. This conclusion suggests that the advantages of chamber-oven coke could be realized in association with higher throughput if the oven could be constructed with a less width." The oven coke has the advantage of higher bulk density in the ratio of 28 to 20 lbs. per c.ft. The time of carbonization of each charge is about 20 hours, the throughput of one oven being from 2·4 to 2·7 tons per day.

It has been intended in both systems that the solid fuel produced should be a real substitute for household coal, both from the point of view of efficiency and comfort. To quote the authors, "it is realized that graded gas cokes and oven cokes can be made to burn freely in open grates if these grates are of a special type efficiently built-in and operating with increased draught. It is felt that there will always be a large demand for a smokeless fuel which can be easily ignited with wood and paper, and which will burn freely in the inexpensive type of grate."

Success at Liverpool.

Fittingly the discussion was opened by Mr. Gibson, who at Liverpool has done much pioneer work in preparing and marketing successfully a smokeless fuel eminently suitable for the open firegrate. There is no doubt about his preference for making such a fuel by carbonizing at high temperatures with as little disturbance of the gas making process as possible. The authors mentioned the advantage of coke with a fairly high bulk density, but Mr. Gibson does not think that this is any great advantage with an open grate fuel. In fact, in Liverpool he advertises that a ton of his special fuel ("Dryco") has twice the bulk of a similar weight of coal. In this way, said Mr. Gibson, amid laughter, the consumer realizes he is getting a good deal more for his money. In any case there is a tremendous field for the sale of solid smokeless domestic fuel, and he hopes that its production will receive much greater attention by the Gas Industry in the future.

The members were glad to have the comments of Dr. Margaret Fishenden, who always puts life into any discussion. She is strongly of the opinion that if a combustible coke can be put on the market at a reasonable price it will have an enormous sale. And she describes as nonsense the idea of immediately replacing coal by gas in the open firegrate. As to easy ignition, whereas formerly she held this to be the criterion for a domestic coke, she has now revised her ideas and believes that low ash content is more important. An open firegrate coke should be readily combustible, so that the fire on being replenished will burn up rapidly. A useful suggestion put forward by Dr. Fishenden is that people who want an ordinary low modern grate and wish to burn coke should put in a grate rather too small for the size of the room, so that they can keep up a rather deeper fire than would normally be necessary. Dr. Fishenden also called attention to the fact that the residue from a gas coke fire can be ignited easily in any open grate—a fact which she maintains should be widely advertised. This also was mentioned by Dr. Lessing, who said that the coke particles have gone through a process

Dr. J. G. KING, B.Sc., F.I.C.

Dr. King was educated at the Royal Technical College, Glasgow, graduating in chemistry, in 1912, with distinction. During this year he also obtained the Associateship of the Institute of Chemistry. In 1912, he was appointed Assistant to Prof. T. Gray in the Technical Chemistry Department of the College, and remained there for two academic years. In 1914 he joined the staff of Nobel's Explosives Co. at their Ardeer Factory, rising during the next few years to Departmental Superintendent. During 1919 he was appointed Research Chemist at the Fuel Research Station at Greenwich and, about two years later, became Chief Chemist. Dr. King graduated B.Sc. (London) in 1921, as an external student, and obtained his Ph.D. in 1925. He is a Member of the Council of the Institute of Chemistry, and has served on several committees of the British Standards Institute and similar bodies. He is the author of a large number of scientific papers upon various aspects of fuel technology.

of partial combustion and therefore have become activated to a certain extent.

Mr. Hodsman, of Leeds University, pointed out that the ignitability of a dense coke can be considerably increased by a partial gasification. Experimental work on this

matter is at present in progress at Leeds, and he expressed the belief that the importance of uniformity of coke can be exaggerated. And, as he stated before the Institution last November, uniformity can be controlled by imparting a skin of coal to the coke. Reference was also made by Mr. Hodsman to the employment of a cheap and speedy method of carbonization which does not necessarily give a uniform product. This product is then graded according to bulk

THE NEW PRESIDENT.

C. VALON BENNETT.

A son and brother of living Gas Engineers, Mr. Bennett is a grandson of Mr. W. H. Bennett, who was for many years Secretary to the Incorporated Gas Institute. He trained at the works of the Herne Bay Gas and Coke Company, and was subsequently appointed Assistant Engineer and Manager to that Undertaking. In 1910 he became Assistant Engineer and Manager of the Dartford Gas Company, which Undertaking later amalgamated with the South Suburban Gas Company. In 1913 Mr. Bennett was selected from a large number of applicants for the post of Engineer to the Rochester, Chatham, and Gillingham Gas Company. In 1918 he was appointed General Manager, and in October of that year became Secretary; and he now occupies the three positions. Great extensions and developments have been carried out at Rochester since 1913. The make of gas in 1912 was 573 million c.ft., while by 1933 it had risen to 1,050 millions. During a part of the war period Mr. Bennett served as a Commissioned Officer in the Royal West Kent Regiment. He was President of the Southern Association of Gas Engineers and Managers in 1928, and is a Member of Committee of the British Commercial Gas Association, the National Gas Council, the Federation of Gas Employers, and of the Joint Co-ordinating Committee of the National Associations. Mr. Bennett is a Freeman of the City of London, being a Liveryman of the Worshipful Company of Paviors.

density, the less dense coke being suitable for the open firegrate and the other portions for purposes for which denser coke is intended. Dr. King thought this statement not quite so important as it sounds. He has examined cokes produced in this way and has found that the percentage of light fuel is very small in comparison with the output of the oven, and, moreover, it is not nearly so combustible as one might imagine.

Mr. W. H. Cadman considers the process in operation for producing domestic coke at the Mines de Bruay is one which the Gas Industry should adopt; but Mr. John Roberts does not agree. He said the process is of no great interest to the Gas Industry, which is essentially a gas manufacturer. He disagrees with the idea that the home of the low-temperature carbonization industry should be the Gas Industry. The latter, he thinks, should not enter the field at all. Mr. Roberts was in fact very critical, and he stoutly maintained that what Captain Shaw had described as two processes are in essence only one and the same thing—treating blends of coke and non-coking coals at medium temperatures. Dr. King pointed out, however, that one is a process of continuous carbonization, the other one of static carbonization—a highly important difference.

Election of Officers.

The Secretary announced at this stage that the following had been elected:

President.—Mr. Charles Valon Bennett (Rochester, Chatham, and Gillingham Gas Company).

Junior Vice-President.—Mr. Stephen Lacey (Gas Light and Coke Company).

Auditors.—Mr. H. D. Madden and Mr. Alfred Morland.

Hon. Secretary.—Mr. W. E. Price.

Ordinary Members of Council, 1934-37.—Mr. W. H. Bennett (Redhill), Mr. George Dixon (Nottingham), Mr. Walter Grogono (Croydon), Mr. W. W. Townsend (Colchester).

District Members of Council.—Messrs. P. D. Walmsley, Great Yarmouth (Eastern Counties); J. A. Rooney, Drogheda (Irish); F. G. Shaw, Buxton (Manchester); T. H. Poulson, Stafford (Midland); George Bruce, St. Andrews, Fife (North British); R. H. Duxbury, Southbank (North of England); J. H. Cornish, Bridgwater (Southern); Octavius Thomas, Porth, Rhondda (Wales and Monmouthshire).

The President referred to the new plan of the Wales and Monmouthshire District Association in electing their representative for a period of three years instead of one year as hitherto, to secure continuity.

On behalf of the members the President extended to Mr. Valon Bennett hearty congratulations on his election and good wishes for a successful year of office, and he also congratulated Mr. Lacey on his election as Junior Vice-President. Both Mr. Valon Bennett and Mr. Lacey returned thanks.

The names of the Hon. Members, Members, Associate Members, and Associates who were elected will be found on another page of this issue.

Mr. Tarratt, in adjourning the meeting until Wednesday

JUNIOR VICE-PRESIDENT.

STEPHEN LACEY, B.Sc., M.Inst.C.E.

Mr. Lacey obtained his engineering training at the City and Guilds College, South Kensington, and after five years with Messrs. G. H. Hill & Sons, Consulting Engineers, entered the service of the Gas Light and Coke Company in 1911 as assistant to the then Distributing Engineer, Mr. H. S. Reeson, whom he succeeded in 1918. In 1923 he was appointed Deputy to Sir Francis Goodenough, devoting special attention to the technical activities of the Departments which, in 1926, were brought together in Watson House. On the retirement of Sir Francis in 1932, Mr. Lacey became Controller of Gas Sales.

morning, announced that the following telegram had been received from the American Gas Association.

"By direction Executive Board in session. Send best wishes successful meeting. Wednesday, 4.30, New York time. We toast Institution here and other cities. Forward."

Impressions of America.

As we anticipated, the three papers giving impressions of the Gas Industry in Canada and the United States of America, presentation and discussion of which occupied the whole of the technical session on Wednesday morning, proved a great attraction. The three authors, Col. Carr, Mr. Masterman, and Mr. Carmichael, discussed respectively gas production; distribution and utilization; and

Col. W. M. CARR, O.B.E., T.D.

Col. Carr was born in the year 1886, and was educated at Manchester University, Owens College, where he took the Engineering Certificate. He was afterwards pupil under the late Lt.-Col. J. Mitchell Moncrieff, C.B.E., Civil Engineer, of Newcastle-upon-Tyne, and was engaged in bridge and dock construction work. He spent a year subsequently in Germany on gas-works and engineering works. In 1907 he joined his father, the late Mr. Isaac Carr, M.Inst.C.E., in his gas and water consulting engineering practice, and assisted in the design and construction of a number of new gas-works, including Thornton, Cleveleys, Frizington, Withnell, and Fazakerley for the Liverpool Corporation, and in practice generally. In 1911, in addition to consulting work, Col. Carr became Engineer and Manager to the Ormskirk District Gas Company, and in 1922 Engineer and General Manager to the Stretford and District Gas Board. He has served for twenty years in the Territorial Army in the 55th (West Lancashire) Divisional Engineers, R.E., being with this unit in France during the war. He also served throughout the North Russian campaign. He was transferred to the Territorial Army Reserve in February last after commanding the regiment for eight years. Col. Carr was appointed Honorary Colonel of the 55th (West Lancashire) Divisional Engineers, Territorial Army, in April, 1934. He received the rank of Brevet-Colonel in 1930, and was awarded the Territorial Decoration in 1929, and the O.B.E. (Military Division) in the last Birthday Honours List.

administration, accounting, and publicity. Those who were present at the meeting, and readers of the "JOURNAL," will have a clear picture of the conditions of the Gas Industry in North America, and in what respects gas practice generally across the Atlantic can give a lead towards furthering the efficiency, stability, and greater usefulness of the Industry in Great Britain. About one thing in particular all three authors are wholly enthusiastic, and that is the effective co-operation and co-ordination of sectional work provided by the organization of the American Gas Association. In this direction, they suggest that we in this country have a long way to go, and something similar might be set up here to great advantage, for it would help to form a united front against increasing competition and would afford a much stronger influence within and without the Industry.

In his paper Col. Carr points out that gas production in Canada and the United States, so far as carbonization is concerned, does not differ materially from British practice. The natural gas resources naturally have an important bearing on the development of the Industry. Among his many interesting observations, the following impresses us. There appeared, he said, to be a consensus of opinion in the United States that, as a result of the ever-increasing price of oil, carbonization will eventually prove to be the most economical method of gas manufacture, particularly in those areas in which cheap coal is available and there is a sustained demand for coke for domestic and industrial purposes.

Of course, carburetted water gas plays a big part in the Gas Industry in the States, and is instanced in relation to particular problems of the Industry described by Col. Carr, together with special features such as complete automatic control, mechanical grates, use of charging machines and automatic control of temperatures. Variations in American water gas practice are commented upon, and the use of heavy oil in place of gas oil in the manufacture of high calorific value of carburetted water gas as a substitute for natural gas is described.

Col. Carr recounts some of the unusual features of the plants visited during the Institution tour. Among these are the installation of waste-heat boilers in the line of flow of hot producer gas from producers to ovens; the utilization of coke oven heating producer gas in conjunction with a process of wet purification; the production of oil gas in continuous vertical retorts; the spraying of coke with dust arresting solutions to prevent evaporation of moisture and dust; and the heating of coke ovens with mixtures of producer and natural gas, and propane-air and coal gas.

In ancillary plant, he says, progress has been more rapid than in this country. Liquid purification by the ammonia, sodium carbonate, and other processes continues to make progress. Electric tar separators have become almost standard equipment; automatic control and mechanization of processes is well developed. The use of control instruments is much more general and tends to the better control of manufacturing operations. In this latter connection, mention should be made of the excellent progress that has been made in the last few years in the science of gas mixing. A careful study of this development, he suggests, might result in considerable improvement in our methods of mixing, and balancing of mixtures of straight coal gas and carburetted water gas. Through the courtesy of the American Gas Association, Col. Carr was able to include as an appendix to his paper a contribution on gas mixing in St. Louis County, which was submitted by Mr. O. R. Allgeier at the Chicago Convention of the A.G.A. last year.

Praise for the A.G.A.

Turning now to the impressions of Mr. Masterman on distribution and utilization of gas in North America, we note his praise of the system of appliance testing and the valuable research and development work at the laboratories of the American Gas Association, by the individual under-

C. A. MASTERMAN, M.A. (Oxon.), F.I.C.

Mr. Masterman was educated at Gresham's School, and gained a Natural Science Exhibition, Balliol College, Oxford, in 1914. He served as Captain with the 1st Battalion The Hampshire Regiment, in France, until wounded in 1916. Later he was attached to the F.S.C., R.E., France, on sound ranging. After the war he resumed his studies at Balliol College, reading chemistry. After taking the Degree of B.A., he remained at Oxford on research for the War Office, and later was appointed Senior Assistant in the Defensive Munitions Department at the Experimental Station, Porton. Mr. Masterman joined the Gas Light and Coke Company in 1927, becoming Senior Chemist, and later Chief Technical Officer in charge of the laboratories at Watson House, engaged on research and testing in connection with gas appliances and other utilization problems.

takings, and also by the appliance manufacturers. The organization of the Industry, he remarked, is flexible, and the personnel technically competent. The most ambitious plans are laid and large sums of money hazarded to a speculative future advantage. To develop a new technique or new application of gas all the resources of salesmanship, publicity, and organization are mustered; the help of the statistical, technical, and other sections of the American Gas Association is enlisted; new departments, perhaps, are

created. If losses or failures are sometimes recorded, this policy of forcing the pace has also to its credit the obvious progress and high morale of the transatlantic Gas Industry.

Mr. Masterman comments on the close co-operation which is maintained with outside contractors and shops for the installation and sales of appliances, and both he and Mr. Carmichael speak of the impressive planning of the showrooms, which are operated to create a friendly social atmosphere. To this end there is no doubt that the Home Service Sections contribute greatly. As to the industrial applications of gas, these are being developed rather by the offering of the extremely favourable rates which are possible where natural gas is available than by any unusual progress in technique. The refrigerator load, favoured by climatic conditions and dietetic habit, is being fully developed. Water heating appliances, chiefly of the storage type, are popular with the exception of gas wash boilers, which are virtually non-existent. The bulk of the house heating is by the circulation of hot air, hot water, or steam, and gas is becoming increasingly popular for the purpose, a specialist section usually operating in this sphere. Domestic cookers contrast with the familiar British pattern in being of enamelled stamped steel construction, tending in the cheaper patterns to sacrifice serviceability to appearance—*e.g.*, unlagged ovens.

It is interesting to learn that hydro-electric developments have not seriously disturbed the popularity of gas for cooking purposes whether in homes, hotels, or restaurants. Both Mr. Masterman and Mr. Carmichael point to the rarity of the slot meter.

Why Not Pressed Steel Cookers?

In Mr. Carmichael's opinion the gas cookers both in Canada and the United States, which, as previously mentioned, are for the most part made of pressed steel, are an improvement on our own. Quite rightly he maintains that one of our most difficult and urgent problems is to get rid of the black cooker, not because it is deficient or fails to give useful duty, but because of its appearance and the financial cost of replacing it with an enamelled cast-iron cooker. A cheaper cooker is needed, he says, and he believes that the introduction of a pressed steel cooker in this country would show considerable saving in replacement costs. It is obvious that Mr. Carmichael thinks that many lessons are to be learned from the organizations of the Gas Industry in America. He points to the fact that amalgamation and joint working of undertakings have taken place in many parts of the countries visited. In Great Britain there are good reasons for gathering the smaller concerns under the wing of a larger and better equipped undertaking, but we are interested to have Mr. Carmichael's opinion, gained from informal talks with friends abroad, that there is danger in going too far in this direction of grouping.

Costs of collections are very high in America. Gas bills there are generally higher, consumers are much more migratory, monthly accounts are general, and discounts of as much as 10% are offered as inducement to prompt payment. The mechanization of office methods has advanced much further than in this country. Mr. Carmichael suggests that this is excessive and is neither desirable nor necessary in Great Britain because the cost entailed is out of proportion to the advantages gained. In regard to rate fixing, the American Gas Industry is much more scientific than our own. The rate schedules of some companies contains as many as ten rates for different classes of service; and Mr. Carmichael emphasizes that gas undertakings here must adopt new methods of charge without delay as one of the most effective means of popularizing the domestic and industrial use of gas. In other directions we are behind in this country. Three reasons are given why our advertisement and propaganda methods are not so effective: Greater appreciation of the principles and practice of advertising and propaganda in America, and a more ready response by the public to the aggressive methods adopted; the wide scope of the work of the American Gas Association, to which the Canadian Gas Association is affiliated; and the reluctance in Great Britain on the part of most undertakings to employ a sufficient number of more highly paid demonstrators and technically trained salesmen.

Then we come to service to the consumer. Here again our methods, though improving, are still behind those obtaining in both the United States and Canada. In this matter, as mentioned by Mr. Masterman, great value is attached to the continued development of co-operative sales activities between the gas undertakings and members of the Plumbers' Association, and it would appear that an extension of this policy by many undertakings in this country is desirable in order to give the public maximum service.

"The thought carried away is that more attention to sales and utilization of gas is urgently necessary in this country and is of vital concern to the well-being of the Industry and to every individual connected therewith." This is the final sentence of Mr. Carmichael's paper. And all three papers giving impressions of the Gas Industry in Canada and the United States urge the co-ordinating of our national bodies to obtain the same driving force as exists in America.

Mr. Richards to the Rescue.

The discussion was opened by Mr. Briggs, of Dudley, who said how impressed he was that in the land of the birth of carburetted water gas apparently carbonization was coming into its own to a great extent. Another point which impressed him is that a smaller percentage of the population of America is supplied with gas compared with Great Britain, and he wondered whether this is partly the reason why the consumption per consumer is so very much higher in America. Mr. F. B. Richards supplied the answer to the query—that the agricultural and rural population of America is much larger relatively than it is over here, and, therefore, a very large proportion of the population is out of reach of gas supply.

Among the many questions asked by Mr. Briggs, was why waste-heat boilers were installed in the hot producer gas pipe line—a point also commented upon by Mr. Clegg. Once again Mr. Richards came to the rescue. He said that the coke ovens in America had been developed essentially for heating by cleaned gas. The producer gas is cleaned before it is passed into the coke oven, and before this gas can be cleaned by water scrubbing it has to be cooled, and one could not afford the thermal loss of a large amount of sensible heat. Hence the waste-heat boiler, which produces enough steam for the producers and for the ancillary plant attached to the producer house.

THOMAS CARMICHAEL, M.Inst.C.E., M.I.Mech.E.

Mr. Thomas Carmichael received his training at the Royal Technical College, Glasgow; in the works and offices of Messrs. R. Laidlaw & Sons; and in the Engineering Sections of the Glasgow Corporation Gas Department, under the late Mr. Alex. Wilson, M.Inst.C.E., Past President of the Institution. From the position of Assistant to the Nottingham Gas Undertaking he was appointed, in 1918, Assistant Engineer to the Portsmouth Gas Company, later becoming Engineer, and he now occupies the position of Engineer and General Manager. Mr. Carmichael was awarded the "H. E. Jones" London Gold Medal by the Institution of Gas Engineers for a paper entitled "Modern Carbonizing Economics Exemplified by Results and Working Costs at the Portsmouth Gas-Works." He is a member of the Council of the Institution of Gas Engineers, and holds various official positions in connection with the National Gas Council, the Joint Industrial Council, the British Commercial Gas Association, the Institute of Fuel, and the Institution of Mechanical Engineers (Southern Branch). He is also a Member of the Board of Examiners (Gas Engineering Section).

In regard to the mixing of coke breeze with coal, before carbonization Mr. Briggs asked if there was difficulty with the breeze separating out from the coal. Mr. Richards once more supplied the answer. He said that the mixing presents no difficulty, and segregation is prevented by pulverizing the coal, to which is added finely powdered breeze. The same speaker believes that the Gas Industry ought to give serious thought to the installation of electrical precipitation plant.

Mr. Clegg regretted that no mention had been made in the paper of the type of carburettor in operation at Burnley, which, it is thought, is the only one of its type in this country—*i.e.*, the checkerless carburettor. And he ex-

pressed surprise that no mention was made of the use of high-pressure gas for internal combustion engines, bearing in mind the high calorific value of the gas.

Dr. Walter feels we have a great deal to learn from the American system of dealing with consumers' complaints. He mentioned that in Birmingham the service engineers work in districts, and in the event of any consumer requiring information in a particular district he is always put into contact with the actual service engineer dealing with the matter. This plan, he believes, tends to increase efficiency. With regard to the certification of appliances he feels that the time is coming when, in this country, we shall have to approve domestic and industrial appliances much in the same manner as the American Gas Association does. Dr. Walter referred to the fact that individual undertakings in America do not appear to have developed the use of industrial research laboratories and industrial showrooms to the extent that we have already done in Great Britain.

Mr. Masterman said that the testing of appliances by the A.G.A. is a very thorough and a very systematic one, but one thing which surprised him during his visit to the States was that the work goes little beyond the carrying out of the rigid test. There is little prolonged co-operative development between the Association laboratory staff and the appliance makers; and in this respect we lead the way. Mr. Masterman was struck by the number of technically competent people who are looking after the installation side, but the design of industrial apparatus appeared to show no advance on this country.

Prices of Appliances.

The question of the introduction of stamped steel cookers came up for discussion. Dr. Walter asked whether it would be possible to design this type of cooker to give even higher efficiencies than are at present possible with the heavier type of apparatus being used in this country. Mr. Masterman says it does not follow that the stamped steel cooker is the only kind of tolerable cooker, or that there are necessarily any technical advantages connected with it. The advantage, if any, is that it may be possible to produce it at a slightly lower cost, but the first necessity is a very large production to cover the very high cost of tools.

On the general price question, Mr. Chandler, of Tottenham, suggested that the makers of gas apparatus have not kept pace with price reduction, and that, while the Gas Industry realizes the expense of research testing and other factors which contribute so largely to efficiency, the attention of manufacturers should be drawn to the further help they can be to the Gas Industry—and incidentally to themselves—by attention to this point. Mr. Chandler said that the plan of employing outside contractors for the installation of appliances is to be commended. By the employment of approved outside contracting firms an undertaking can establish a permanent staff of skilled fitters and retain this staff irrespective of the amount of work the department is called upon to perform, and the necessity for the engagement of temporary employees to keep up with a rush of work is avoided. This matter was also referred to by Mr. David Fulton, who said that if we are to maintain the sales of appliances a reduction in their cost is necessary.

Mr. Chandler asked why the prepayment meter was so rare in America, and Mr. Tarratt replied that in the States they started slot meters in the same optimistic spirit that we did in 1898, but robberies were too numerous for the idea to be continued.

Organization of the Industry.

Perhaps the most important part of the discussion was concerned with the desirability or otherwise of reorganizing the Gas Industry in this country on the lines adopted in America—whether it would be better to have one gas association with a managing director at the head. It was a question of " for " and " against," and no mistake. Mr. Lapthorne, Chairman of the Portsmouth Gas Company, is very definitely " for," and he maintains that no personal considerations should be allowed to interfere with or prevent the realization of a single Association to represent the Industry. Mr. Fulton is of the opinion that there is a strong favourable following in this country for such a measure. We will quote a few of his remarks: " If it is true, as a philosopher said, that the desire for power is inherent in the human breast, then the identity of our national bodies does contain the danger of conflict as to which shall be the uppermost in prestige and influence. That, I think, is really almost unavoidable, and so long as that is the case I do not think the work will be so well co-ordinated as it would be with a single managing director working through specific committees."

On the other hand, Mr. Madden and Mr. Botley, as well, of course, as Mr. Tarratt, are staunch supporters of the present system. Mr. Madden believes that the strong individuality of the several bodies will enable us to function satisfactorily under the new Joint Co-Ordinating Committee. For this country, he says, this is a very much better plan than being under one association. " One association?" asked Mr. Botley. " You may depend upon it that so far as I am individually concerned I shall continue to resist it to the utmost." Mr. J. H. Canning, while not expressing any very definite views, pointed out that we began on the American system. The original Gas Institute embodied practically all the interests connected with the Gas Industry. This, however, produced conflicting interests, and a species of internal strain or friction was set up. In fact, just at a time when electrical competition was beginning to make itself felt there was an unfortunate split which lasted for twelve years.

The obvious conclusion to be arrived at as a result of the discussion is that the case calls for exhaustive consideration and examination.

The Macclesfield Charging System.

At the final session on Thursday morning two papers were presented, the first being by Mr. Curtis, of Macclesfield, on the very important subject of charges for gas. The paper is indeed proof of what can be accomplished by abandoning the flat rate charge and introducing a charging system which offers inducement to all types of consumer to make greater use of gas service. Mr. Curtis claims with every justification that the outstanding success which has attended the policy he outlines is primarily due to selling a public commodity at popular and attractive rates, and that it is not due to any exceptional circumstances surrounding the development of the district served by the gas undertaking. Macclesfield is a town of some 35,000 inhabitants, a figure which has not increased in any abnormal manner during the last ten years—the period under review. The main industry, that of silk, has suffered to some extent from the general depression, and the effects of the depression have not been alleviated by the introduction of any new industry. Nor have new housing schemes proceeded at anything more than average rate. It cannot be said, either, that the policy of the undertaking suffered from any lack of energy, foresight, or ability in the years preceding those illustrated herein. Indeed, the Macclesfield gas undertaking has always been characterized by a progressive spirit. It was at Macclesfield that Mr. J. E. Blundell introduced the method of steaming in continuous vertical retorts, and his spirit of enterprise and scientific initiative was continued by his successor, and Mr. Curtis' predecessor, Mr. F. W. J. Belton, now of Christchurch, New Zealand.

The paper gives an account of the developments which led to the introduction of the Seasonal Differential System, describes the system itself in detail, shows the effects of its introduction on the annual and seasonal consumption of gas, and finally compares the system with others which have been advocated.

Prior to 1923 the system of charging for gas in Macclesfield was a flat rate at 11½d. per therm, with slight reductions for power purposes. A new scale of charges was introduced in 1923 in the form of a block system, with reductions in steps commencing at 40 therms per quarter, with two further reductions at 100 and 250 therms per quarter, after which the rate became a flat one at 9d. per therm.

In 1928 the Seasonal Differential Charge was introduced. The basis of the scheme is a charge of 7½d. per therm for the first approximately 40 therms per quarter, graded down on a smooth curve to 6d. per therm at 300 therms per quarter. From this scale discounts for cash within 21 days are given at a low rate in the winter months, and a higher rate in the summer months. The paper describes the steps by which the present position was reached in which the discounts are 7½% in the winter months and 50% in the summer.

More Sales per Consumer.

Tables and charts are given which exhibit the effects of the system on the sales of gas per consumer, the general growth of the undertaking, and on the capital and other charges per therm of gas sold. Since the introduction of the scheme the quantity of gas sold has been increased by nearly 25%—that sold through ordinary meters by 15·7%, and through prepayment meters 31%—while the average consumption per prepayment meter has been increased by 21·6%. The effect of the scheme on the seasonal load is shown by the fact that the increase in the summer period is 27·8%, and that in the winter 17·6%. The average price of gas has been reduced by one-half during the last ten years, though it is not, of course, claimed that this is due entirely to the new system of charging. It is contended that the system is simple, popular, and effective in in-

creasing and retaining remunerative sales. It stimulates demand during the months when consumption naturally languishes. It encourages the purchase of apparatus in the summer, the use of which is largely continued in the winter. It levels the seasonal load, while increasing the annual demand and reducing the overhead charges per therm. It does not entail any alterations to prepayment meters when changes are made in the rate of discount which are virtually changes in gas charges. No arbitrary

H. CURTIS.

Mr. Curtis was educated at the Municipal School of Technology, Manchester. He received his early training with Messrs. West's Gas Improvement Company, Ltd., Manchester, and later was appointed Supervising Engineer in Ireland on the erection of vertical retorts. He was appointed Assistant Engineer and Manager at Macclesfield in 1918, becoming Engineer and Manager in 1924.

assessment is necessary, as in two-part tariffs, and the system being applied to all consumers eliminates the possibility of invidious comparison between one class of consumer and another.

Praise and Criticism.

The valuable discussion on the paper by Mr. Curtis can really be divided into two sections. Those who praised the author whole-heartedly and commended his system, and those who criticized it fairly severely. In the former section came Mr. McLusky, of Halifax, and Mr. Haynes, of Rotherham. Mr. McLusky is of opinion that Mr. Curtis's scale embodies the best in a block tariff and excludes the worst. His scale embodies some of the better features of the old discount system with none of its disadvantages. The old discount system started with a moderate maximum price, but in the block system the starting price is high and forbidding and is often quoted at the price of gas. Moreover, the Macclesfield scale has the merit of simplicity.

"Whether or not one favours two-part tariffs, block systems, or seasonal discounts is, to my mind, of less importance than the will to do something and to do it thoroughly, and I suggest that it is time that the National Bodies gave a lead in this matter. What a glorious opportunity for the new gas corporations with their improved facilities and organizations!" We quote Mr. Haynes, who has succeeded so well with his two-part tariff at Rotherham, and who obviously prefers this system to that of Mr. Curtis's.

Several speakers expressed the view that with such favourable gas pricing as obtains at Macclesfield, a two-part tariff would have been the better proposition. Several speakers, too, pointed out—as indeed Mr. Curtis himself admitted—that his system has not succeeded in increasing the summer load in greater ratio than the increase in the winter load, and that the general tendency with seasonal differentials is that the summer load is increasing. Mr. Ridley thinks that the very large reduction in the summer months at Macclesfield cannot be justified by the cost of the winter peak, seeing that normally about 40% of the total sales is in the summer six months. Apart from equity, so wide a difference has the disadvantage of making the winter accounts, with the naturally greater consumption, too heavy by comparison with the summer accounts in fighting lighting and heating competition. Also the scheme gives full benefit to the uneconomic as well as the remunerative consumer. In this matter of the seasonal variation of load. Mr. Briggs suggested that this is not the entirely unmixed evil that the paper might imply. As far as his retort plant is concerned, his own present seasonal variation is only just sufficient to enable overhauls to take place. Mr. Briggs also put forward the view that a flattened hourly load curve is much more important than a flattened monthly load curve. What Mr. Curtis has done, he said, is to make out a very good case for cheap gas. "I think," remarked Mr. Briggs, "that the real moral to be drawn from the paper is that cheap gas will sell more gas, but that when cash surpluses are available for reducing prices, better results can be achieved by some differential rate method than by a flat rate reduction upon an existing flat rate scale." He suggested that the multiplication of rate charges may, by arising confusion, become a weakness in the Industry, and he urges the National Gas Council to give a lead so that the number of methods may not become unduly great.

Surprise was evinced during the discussion as to why Mr. Curtis prefers the step rate system to the block rate, which eliminates the difficulty of marginal relief. Whatever the criticism, however, Mr. Curtis must have been remarkably pleased with the way in which his paper was received, and have felt fully rewarded for his effort in compiling a paper which is bound to be of great use to all who are contemplating a break-away from the flat rate charge—and we hope that this break-away is a general tendency in the Industry. As Mr. Blundell so well expressed it, the figures given by Mr. Curtis exhibited an undertaking in a very sound and prosperous condition, with all the elements of future success.

Benevolent Fund.

Before the final paper on Thursday morning, there was a general meeting of the contributors to the Benevolent Fund of the Institution. In moving the report of the Committee of Management of the Fund, the President appealed for an increase in the number of subscribers—an appeal which had support from Mr. Octavius Thomas, who proposed the vote of thanks to the Chairman and Honorary Secretary of the Committee, and from Mr. Keable, who seconded the vote. Mr. S. E. Halliwell and Mr. D. M. Henshaw were elected to the Committee of Management for the next three-year period.

Modernizing Small Undertakings.

The varied programme of the meeting was rounded off by a paper by Mr. D. B. Parkinson, of the British Gas Light Company, Ltd., dealing with the topical question of modernizing small gas undertakings. It records what has been done in some of the works of the Company and its Subsidiaries. There has, of course, been a general desire to improve the efficiency of small concerns so that they

D. B. PARKINSON, M.A.

Mr. Parkinson was educated at Birchington and Oundle. In 1919 he went to Cambridge and took a degree there in 1922. During the next year he gained workshop experience with the Compagnie pour le Fabrication des Compteurs, Paris. Then for three years he was a pupil engineer of the Gas Light and Coke Company at Beckton, Fulham, and the Distribution Department. In 1927, Mr. Parkinson was appointed Assistant Engineer at the Nine Elms Works of the Gas Light and Coke Company. Two years later he became Engineer at the Chief Office of the British Gas Light Company, Ltd.

may be brought nearer the high standard which is the aim of the Industry as a whole. With the fierce competition of the electricity grid and oil burning domestic apparatus, many of the small companies will go under unless obsolete plant is brought up to date. It is usually lack of capital

rather than the lack of desire that prevents improvement, and when this is the case, the difficulty may often be solved by purchasing a bulk supply from a large neighbouring works or by the company becoming a subsidiary of one of the corporations formed to control small undertakings. In the first case, the works are usually shut down and the gas supplied from the larger works, either into the holders or direct to the district, so that it is only the district mains that have to be put in order; in the second case, money must be spent on both the works and district. The proper financing of these small undertakings is only possible where capital is available and immediate return is not essential.

The necessity of good service to the consumer is emphasized by Mr. Parkinson, but this cannot be really effective until the plant is put in order. Price is of importance, but the provision of gas of regular quality and pressure with proper maintenance of apparatus is perhaps more important. The British Gas Light Company, with its staff of Engineers, Chemists, and Salesmen always available, is well able to deal with any troubles that may occur in the undertakings under its control; and this policy has been justified by results. The term " small gas undertakings " is taken to include works with annual outputs varying from 3 million c.ft. to 100 millions.

On several works, new carbonizing plant has been installed and the opportunity has then occurred to introduce some special features to suit the size and conditions of the undertaking. Four such installations are described, and in two instances show how an old type of plant, when modernized, has its uses for small works, while in the other two, the most up-to-date types have been erected.

Reconstruction of plant and buildings is dealt with, indicating how the grouping of undertakings is of assistance in this work, not only financially, but by the transfer of plant from one to another. Carbonizing plant reconstruction is described separately and details are given of two instances of somewhat unusual character. A short section is devoted to coal gas dilution. The general reconditioning of a works after taking over control is described and examples are given of plant re-arrangements both with new buildings and with the conversion of existing buildings.

Distribution problems are discussed, with low and high pressure, showing how extensive relaying of mains is often necessary in a small undertaking to put the district in order, and how in some cases the difficulties can be overcome by boosting. A direct high-pressure supply to outlying villages is also described.

The final section of Mr. Parkinson's paper is concerned with the actual linking-up of works by which substantial economies can often be effected. Examples are quoted to show how considerable works reconstruction may be required before linking can be accomplished, and how at other times this may be unnecessary; also how the work can sometimes be facilitated by linking the undertakings before commencing alterations to works plant.

Dogmatism Out of Place.

Colonel Carr, who opened the discussion, said that the paper demonstrated clearly enough how impossible it is for anybody to dogmatize as to which system of carbonizing plant may or may not be the best. On that point alone, he remarked, the paper is of enormous value. It was natural that Colonel Carr, who was responsible for the first installation of Congdon standpipes in this country, should have observations to make regarding their application to small works, and in particular to the circulation of liquor through the system. Reference was also made by the same speaker to the dilution of coal gas by producer gas.

This matter of producer gas dilution was also commented on by Mr. H. J. Toogood, who looks upon the method as a palliative solely. He thinks the day has come when we should make water gas by steaming horizontal retorts, and he suggested that the arrangement might well be tried of admitting steam into the centre of the length of a through retort. He had a good deal to say on the improvements by which economy can be effected and efficiency increased in small horizontal settings. The main arch he regards as unnecessary, and thinks much of the brickwork in horizontal retort settings should be deleted. Nor is there need, he suggests, for the producer arch. Both Mr. Toogood and Mr. Clark Jackson, of Neath, believe in the application of waste-heat recovery in small works—undertakings with outputs from 25 to 40 million c.ft. A gas company in which Mr. Jackson is interested turns out 30 million c.ft. a year and all the steam for the works is generated by a waste-heat boiler. The plant consists of three settings of horizontal single-end retorts. Also, there is room for the small automatic blue water gas plants now on the market.

A useful contribution to the discussion was made by Mr. Lucas, of Newhaven, who explained by reference to his own undertaking what can be done on a small works granted enterprise and initiative and good backing from a board of directors. The important question of service, which one speaker described as the weakest link in the organization of small undertakings, also came in for comment.

Concluding Proceedings.

The President reported that the Second International Gas Conference will be held in Zurich from Sept. 1 to 4 next, and expressed the hope that many members would attend. A cable had been received from Herr Fritz Escher asking them to have as good a muster as possible to support their President-elect at that meeting.

Mr. Tarratt also reported that the Research and Education Reports for 1933-34 will be presented at the Sixth Autumn Research Meeting in London on Nov. 6 and 7, 1934, and that the 72nd Annual General Meeting will be held on June 4, 5, 6, and 7, 1935.

Mr. W. W. Townsend, of Colchester, proposed an omnibus vote of thanks to all who had contributed to the success of the meeting. Before doing so he remarked that the member of Parliament for Colchester, Mr. Oswald Lewis, had taken a very great interest in the Gas Undertakings Bill. He was the Member of Parliament who moved an amendment to insert in that Bill the Minimum Charges Clause to which the Industry attached so much importance. That was resisted by the Government, and therefore had to be dropped. It was a defeat for the Industry, but Mr. Lewis was not deterred, and he moved another amendment which was accepted by the Government and had the effect of debarring local authorities from prohibiting or restricting the use of gas on their housing estates. This was a great victory. " We have been having this battle now for several years," said Mr. Townsend, " and we are very greatly indebted to the individual undertakings, led by Kettering, who took up this matter, which has also been fought by the Gas Light and Coke Company and other large undertakings. Now, however, if the Gas Undertakings Bill goes through in its present form we shall have general legislation upholding the right of gas undertakings to supply the tenants of council houses with gas."

Mr. L. J. Langford, of Tunbridge Wells, seconded this vote, which was carried with hearty acclamation.

Mr. W. E. Price (Hon. Secretary), and Mr. Alexander replied. Mr. Alexander said he welcomed the first opportunity of thanking publicly the hard working staff of the Institution. They backed him up in a marvellous manner, and this was no empty formality. He said very sincerely that they were loyal servants of the Institution, and on their behalf he thanked the members for the vote of thanks.

Presentation of Presidential Certificate.

Mr. C. Valon Bennett said it was a great joy to him to know that his first official act was to ask the members to pass by acclamation a vote of thanks to Mr. Tarratt and at the same time to present to him the Presidential Certificate. " Mr. Tarratt," he observed, " is probably getting tired of being told what a wonderful President he has been, and I am afraid that I know of no words which can adequately express our gratitude to him. I will say this without the slightest fear of contradiction, that we never have had and we never shall have a better President than he has proved himself to be. Unfortunately I was not able to go with the President and the other members of the Institution to Canada and the United States in September last, but it is common knowledge that this Institution stands higher to-day in the eyes of those gas engineers Overseas than ever it did, because of Mr. Tarratt and his conduct wherever he has been." Mr. Valon Bennett also asked Mr. Tarratt to convey to Mrs. Tarratt the thanks of the Institution.

The President: I desire to thank you most heartily, Mr. Bennett, for your kind words in regard to my wife and myself respecting the duties that have fallen on us during the past twelve months. We have both endeavoured to uphold the dignity of this Institution. It was a great joy to us, although it was a big responsibility, to head the delegation to America and Canada. This year has been a strenuous one, but a very happy one as far as I have been concerned. I shall always look back with the greatest pleasure to the year when I was President of the Institution I accept with grateful thanks this Certificate, which I shall always look upon with the greatest satisfaction as a record of work done for the Institution.

A most successful meeting, characterized by close adherence to programme, then terminated, 13½ minutes after scheduled time.

Many photographs in connection with the Visits will be found on later pages.

Presidential Address

By FRANK PEAKE TARRATT, M.Inst.C.E.

Engineer, Newcastle-upon-Tyne and Gateshead Gas Company.

A year ago you elected me as President of the Institution, for which honour and for the support you have given during my period of office, I ask you to accept my sincere thanks.

Canadian and American Gas Associations.

The responsibility of representing the Institution on numerous important occasions was most marked when, in the Autumn of last year, I had the pleasure and privilege of leading the delegation of Gas Engineers and other representatives of the Gas Industry to Canada and the United States of America. What we saw during the Visit, which was fully reported in the Gas Press, has been a source of inspiration and not without its effect in the vital deliberations concerning our Industry in recent months. To our Canadian and American colleagues I again offer our cordial thanks for their kindness. We are hopeful that conditions overseas will permit the Canadian and American Gas Associations to accept our invitation to visit us in 1935, when we shall endeavour to return the hospitality which they extended to us and to make their Visit equally useful and instructive.

At this, the 71st Annual General Meeting of the Institution, impressions of the Gas Industry in Canada and the United States of America form the basis of three Papers by Colonel W. M. Carr, Mr. C. A. Masterman, and Mr. Thomas Carmichael. Our Canadian and American friends were anxious that we should record and discuss our impressions, and I am hoping that their value will be enhanced by useful discussions on the comparison between American and British practice in the production, distribution, and utilization of gas and the business conduct of Gas Undertakings.

Co-Ordination of National Gas Organizations.

Contrary to what might be expected, our Visit to the United States of America has not convinced me that the merging of the Institution, the National Gas Council, the British Commercial Gas Association, and the Society of British Gas Industries into one Organization on the lines of the American Gas Association would be advantageous. This is no reflection on our American colleagues or their Association, the essential usefulness and strength of which cannot be too strongly emphasized. The historical and economic development of the American Gas Industry, however, has been entirely different from that of the British Gas Industry and no useful analogy presents itself in the American Gas Association and the four British Gas Organizations, which, like the British Constitution, are illogical in theory but extremely effective in practice.

Close personal contact exists in our separate Organizations and any shortcomings in their work would not necessarily be remedied by " constitution-mongering." Indeed the remedy has already largely been found in the recently constituted Joint Co-ordinating Committee, which—equally representative of The Institution of Gas Engineers, The National Gas Council, and The British Commercial Gas Association—has done much to co-ordinate the work of the separate Organizations. Formed particularly to discuss broad matters of policy, I hope it will provide a lead on many important problems by communicating its views to those responsible for the conduct of Gas Undertakings.

Two National Conferences were called last year, as a result of which it was decided that the work to be done justified the Joint Annual Subscription to the Central Fund of the three Organizations being increased to ten shillings per million cubic feet of gas sold. The Joint Co-ordinating Committee has established a Technical Sub-Committee representative of the recently formed Industrial Gas Development Centres.

Gas Charges.

The Industry has been pressing for many years for amended legislation to give it greater freedom of action. The National Fuel and Power Committee made such recommendations as long ago as 1928, but it is only now that effect is being given to some of them. The Gas Undertakings Bill of 1934 contains certain important provisions which will be of value to the Industry, but the Bill is not as comprehensive as the Industry is entitled to expect. The methods of charge permitted do not come up to the standard of freedom of our competitors, most of whom have power to make minimum charges and all are entitled to make application to a Government Department for authority to operate a multipart tariff, without giving consumers the option of an alternative flat rate charge. The Wrottesley Committee recommended in 1933 that minimum charges should be authorized, but the necessary power is not included in the present Bill, nor is effect proposed to be given to the Committee's recommendation for the simplification of procedure and consequent reduction in the cost of securing Board of Trade Orders to which there is no opposition.

The Bill does, however, enable Gas Undertakings to put into operation any form of tariff without in some cases running the risk of exceeding maximum prices, and in others of endangering the rates of dividend payable. Multipart and such-like tariffs are not to be introduced without the consumer having the option to be charged on the flat rate. In practice the Electricity Undertakings' multipart tariffs are similarly optional to consumers, but that Industry started early to operate tariffs and consequently has been able to keep flat rates at high levels, thus enabling attractive alternatives to be offered and providing an incentive to increased consumption at low rates. The Gas Industry, with its Statutory regulation of dividends by the price of gas charged to the smallest consumer, finds itself with flat rates at low levels.

If the Gas Industry could get the uneconomical consumer to pay his full share of standing charges, or to approach nearer to that stage, it would be in a position to offer more attractive tariffs to the economic consumers. Minimum charges help in this direction, and the Wrottesley Committee stated that they should be introduced for the purpose of lessening the burden of uneconomic consumers upon the general body of consumers.

The introduction of attractive optional tariffs results in serious loss of revenue, unless the existing price to small uneconomic consumers can be raised or unless a largely increased consumption is obtained immediately. But such an increase cannot be immediately secured, and, consequently, optional tariffs may be impossible for Undertakings (*a*) not having surplus revenue which they are in a position to give up or (*b*) not in a position to reduce their working expenses.

With the assistance of Appendix " E " to the Report of the National Gas Council Committee on Gas Charges, issued in 1928, each Undertaking can work out two and four-part tariffs and these would provide a basis upon which to build up a method or methods of charge suitable to local requirements. Our experience in Newcastle has been that the two-part tariff has met the requirements of the large Industries of the district, but we have found that only at a loss of revenue too great to contemplate could we modify that tariff to make it attractive to a large proportion of domestic consumers. We have considered block systems which would be attractive to domestic consumers, and have calculated the result of

applying them to the industrial consumers in lieu of the two-part tariff. We find that either the block system would involve too great a loss of revenue or be insufficiently attractive to the large industrial consumers. It has, therefore, been decided that it is expedient to introduce a separate tariff applying only to domestic consumers.

It is very desirable that every Gas Undertaking should at once seriously consider what methods of charge would be most attractive for increasing the sale of gas in its area. Most of us have a great deal to learn with regard to the subject; the more it is studied in detail the more the importance and the difficulties of the matter are realized, as will be seen from a careful study of Mr. W. H. Curtis' Paper on the correlation of costs and gas charges, to be presented and discussed at this Meeting.

Gas Referees.

I regret that under the Gas Undertakings Bill it is proposed that the duties of the Gas Referees should be transferred to the Board of Trade in January, 1939. The Industry owes much to the ability and impartiality of the Gas Referees in carrying out their obligations and in safeguarding the interest of gas consumers. It was doubtless due to their consummate tact that the radical changes in the Gas Regulation Act, 1920, were made operative with so little inconvenience to all concerned.

Amalgamations of Gas Undertakings.

Following the suggestions of successive Governments, amalgamations of Gas Undertakings or their utilization of surplus coke-oven gas supplies have tended to consolidate the Industry. Although this development carries with it many hardships, the balance is distinctly in favour of increased efficiency and economy. The policy must be pursued whenever the proper and appropriate opportunity occurs, but not otherwise. Mere financial grouping, or the addition of one economic unit to another economic unit, is not in the best interests of the Gas Industry, as the exponents of wholesale rationalization have learnt. What can be done to modernize small Gas Undertakings is well illustrated in Mr. D. B. Parkinson's Paper to be presented and discussed at this Meeting.

The progress reported at the first Annual General Meeting of the South-Eastern Gas Corporation, Limited, is significant of the benefits to be obtained by centralized control. It has been described as a modest experiment in regional planning, and it is evident that the purchasing of materials in the best markets and the standardization of technical methods cannot fail to be of benefit to both consumers and shareholders. The pursuit of such a bold policy, within the limits I have indicated, must awaken a new spirit in the Industry.

Competition.

The Gas Industry is in a more intensely competitive position than ever before; every advance has to be made with care yet with courage born of confidence in the commodity we offer. The great need of the world to-day is a revival of International Trade, so that the heavy Industries may regain a volume of trade which is adequate for their efficient and economic development, even for their very existence. From such a revival the Gas Industry would directly and indirectly prosper.

Whilst, as Engineers, we are constantly modernizing our plants, improving our methods and adapting the processes of manufacture and distribution to enable gas and the by-products of coal to be produced at the most economical figure, we must not ignore any opportunities there may be of obtaining bulk supplies of coke-oven gas at advantageous costs. The commercial prosperity of our business is dependent upon gas being available at prices which enable the competition of oil and electricity to be met, the more so as the efficiency and convenience of alternative fuels increase. Given gas at such prices there are many processes for which it can be used industrially with advantage, although it is essential that the value of each prospective customer should be carefully assessed and a schedule of charges evolved that will meet his case.

The competition we have to meet makes it evident that, using to the utmost the machinery and resources of the four National Gas Organizations, we must adopt fresh methods and extend existing and develop new uses for gas and its by-products. I am optimistic enough to think that, if the Industry realizes immediately the importance of research and technical investigation on a scale hitherto hardly visualized, we may regard the full development of the use of gas as just commencing rather than terminating as some profess to believe. We must, however, recognize our limitations; no one fuel has all the virtues. If we concentrate on those many uses for which gas is equal or superior to all other fuels, our critical competitors would be deprived of much of their ammunition. In Canada and the United States of America the availability of cheap electricity has not excluded gas, which, in fact, is used to an increasing extent, the consumer recognizing the merits of gas and electricity and using each for the purposes for which it is best suited.

The amount of capital invested in gas concerns cannot be lightly ignored, neither can the displacement of an adequately paid and contented class of workmen, who have the benefits of established pension and sick funds and all the machinery necessary for negotiations as to wages and employment. Gas makes use of our natural supplies of coal and provides gaseous and solid fuels and various indispensable by-products such as tar. The National importance of the Gas Industry tends to increase rather than diminish, for the use of compressed gas for motor vehicles and other purposes and the increasing production of benzole on gas works, are making us less dependent upon foreign oil, although not as yet to an extent which affords relief to those responsible for the defence of the Country in time of War. Some of the aspects of benzole recovery and refining are dealt with in a Paper to be presented and discussed at this Meeting by Mr. S. W. A. Wikner and Mr. Bernard Richardson.

Uses for Gas.

The prices to be obtained for gas for many large and small scale industrial and commercial processes, may at first appear unreasonably low compared with what we have previously considered to be a figure carrying a fair profit. We must take the long view, however, and remember that most manufacturing concerns are working far below their real capacity and any substantial improvement in their trade might at once make them profitable consumers. Our greatest competitors are more than ever anxious to secure a higher output for their commodity and they are counting on greater demands when trade improves. The application of gas for industrial and commercial purposes must be explored to the utmost; only the fringe of the technical aspects involved can be regarded as having been reached. What can be done is well demonstrated by Dr. H. Alex Fells' Paper, which is to be presented and discussed at this Meeting and which describes the use of gas in the Steel Industry.

Lighting and Cooking Loads.

The domestic lighting and street lighting loads should not be lightly passed over to electricity. It is clear that the Gas Industry in Canada and the United States of America made no real effort to retain lighting and, having seen gas street lighting in Great Britain, they regret they did not pursue a more vigorous policy. Nevertheless, in this country we must realize and realize immediately that electric street lighting is being immensely improved so as to make it comparable with gas lighting. We are doing relatively nothing, however, in the way of research and technical investigation to keep gas street lighting ahead of electric street lighting in its efficiency and economy. Shall we be alive to the position when the load and its attendant publicity has gone elsewhere? If a high pressure supply of gas is necessary and high pressure mains cannot be widely laid, the technique of gas street lighting must be developed in respect of the low pressure supply.

Do not let us feel too self-assured about the retention of the cooking and heating load, although these are fields

in which gas stands supreme. We shall not retain the cooking load unless we keep abreast of modern improvements and supply more generally cooking apparatus of attractive appearance, all enamelled, easily cleaned and in keeping with the general design of modern kitchens, where labour saving devices are being constantly introduced.

Research.

It was on account of the demand for increased efficiency in carbonizing processes that attention was given to the properties of refractory materials, but although the Refractory Materials Joint Sub-Committee of The Institution of Gas Engineers and the Society of British Gas Industries was formed in 1909, it was not until 1920 that the British Refractories Research Association was established. By the end of the present year the Association will have published 34 bulletins, embracing 185 papers and reports of their investigations while the total amount expended annually has rarely been more than £4,500. It is gratifying to think that the Gas Industry responded adequately to the appeal recently made for increased funds to support and extend this valuable work.

As early as 1912 certain Specifications for gas works refractories were drawn up, these being the first Specifications for refractories to be formulated by any Industry in this country. Revised Specifications were issued in 1922 and 1925, and during the past year considerable time has been spent by the Joint Sub-Committee on their further revision in the light of recent advances.

The corrosion of metals is being investigated by the Joint Research Committee of the Institution and Leeds University, the ultimate object being the elimination of corrosion troubles and their attendant inconvenience and expense. Sulphur compounds in the gas are mainly responsible for this corrosion and every endeavour must be made, therefore, to reduce the sulphur content. As the removal of sulphur may prove costly, however, it is necessary to determine, by balancing the costs of purification against those of maintenance, if its partial removal is not the most economical.

Laboratory experiments must accord with the essential factors of service conditions. Twelve materials have been already subjected for nearly a month to the continuous action of the products of combustion from coal gas and their resistance to corrosion has been classified. Further experiments will be made with gas containing diminishing sulphur contents, and to investigate further those materials which have shewn the greatest resistance to corrosion, namely, lead, tin, and their alloys. If we consider the improvements in the quality of gas since the thermal method of charge resulted in a uniform specific gravity, freedom from naphthalene and low moisture content, it should not be beyond our power to reduce the sulphur content.

It is practically impossible to evaluate the research work which has been carried out by the Gas Industry. Improvements in refractory materials alone have considerably lowered the cost of the repair and maintenance of carbonizing plants and has enabled us to increase the productive capacity of manufacturing plant far beyond anything we could have foreseen twenty years ago. The leading manufacturers of gas apparatus have done much in recent years in their research laboratories to produce more efficient and more economical appliances for cooking and heating purposes, although the prices of such appliances, like the charges for gas, could be lowered to facilitate competition with other increasingly efficient appliances using different fuels.

Sir Arthur Duckham Memorial Fund.

In the late Sir Arthur Duckham the Gas Industry had a great advocate of the necessity for continued research and it is satisfactory to think, therefore, that the income from the Fund which was inaugurated this year to perpetuate his memory, is to be applied for the period and purpose of specified investigations of interest to the Gas Industry at places at home or abroad selected as being appropriate for the conduct of each particular investigation. The response to the appeal has been exceedingly gratifying, over £10,000 having already been contributed. The number of personal donors, however, is not as large as the cause and the popularity of Sir Arthur undoubtedly justifies. I appeal, therefore, to everyone conversant with his remarkable creative energy and extraordinary powers to give something to the Fund before the lists are closed this month. It is the least we can do in memory of one who served the Gas Industry so well.

Benevolent Fund.

In making this appeal I am reminded that support of the Benevolent Fund of the Institution is not as satisfactory as it should be—only 867 of our 1494 members contribute. No one denies that there is distress amongst certain of our members and their dependents and no one denies that the Benevolent Fund does much to alleviate it. Is it too much to ask, therefore, that all members should give something towards the assistance of their colleagues in need?

By-Products.

Recent advances in our manufacturing processes enable us to make and select cokes best suited for the particular district supplied. In many towns the demand is for a hard coke for central heating; in other districts there is an increasing demand for a lighter and easily ignitable coke, which can be produced in vertical retort plants. This business can be secured and retained only by using a selected blend of coals with a low ash content and by carefully screening and grading the coke to suit the varying requirements of our customers. A Paper upon the production of solid smokeless fuel is to be presented and discussed at this Meeting by Engineer-Captain J. Fraser Shaw and Dr. J. G. King.

I am hopeful that the sale of residual products will again become more profitable. There would appear to be an upward trend in the prices obtainable for sulphate of ammonia, and there is an increased demand for prepared tar for road making purposes, mainly brought about by the British Road Tar Association, which checked the import of foreign material. The hydrogenation of tar and creosote is apparently beyond the experimental stage, and the completion is shortly anticipated of a scheme inaugurated by Imperial Chemical Industries, Ltd., and of which the Minister of Mines would appear to be enamoured.

Administration of Gas Undertakings.

I have purposely refrained from referring to any Engineering work I have carried out since I had the responsibility of controlling the Engineering side of a Gas Undertaking, feeling that such a subject is best presented in a Paper rather than in a Presidential Address, although this is contrary to the course pursued by my old chief, the late Alfred Colson, who when President of the Institution in 1894, referred specifically to the working up of residuals at the works under his control.

Although I am an Engineer I do not lose sight of the fact that I am addressing many members who are both Engineers and Managers. In years past the major portion of their time was spent in engineering problems, but to-day the position is changed and a greater proportion of their work is devoted to the commercial side. Much as Engineers desire to erect structures that are monuments to their engineering skill, they now have to plan their works so that the plant is housed in the simplest manner, consistent with economical operation and maintenance, giving it the necessary protection against weather conditions and limiting the capital expenditure as far as reasonably possible. Engineering Contractors have in recent years developed on specialist lines, and they can now supply gas manufacturing plant and equipment under guarantees which assure definite working results and which meet the special conditions applicable to our locality and control within reasonable limits the cost of gas into the holder.

On the Distribution side, however, such limitation of expenditure is impossible. The congestion of public

utility services is so great in the principal thoroughfares that it frequently becomes impossible to add to the number or size of our mains. We have to evolve special schemes of high pressure gas supply to meet the demand for gas over a much larger area and further away from the manufacturing stations. Large sums must be expended on the mainlaying necessary for housing schemes under which the number of houses to the acre is very limited. Each consumer costs more to reach and equip and, lower distribution costs being unlikely, we must look in other directions for increased revenue and endeavour to fix scales of charges which will enable us to secure and maintain increased consumptions.

Corporation Gas Undertakings.

Those in charge of Corporation Gas Departments where there is an Electricity Department, have a most difficult task. If the best is to be obtained from both Departments, it is more than ever essential that the Council should have sufficient vision to ensure that justice is done to both Departments, that the management is unbiased, and that the principles of sound business are not ignored. In many towns considerable sums have been expended on the two services and in due time the capital must be repaid. Gas Departments have long been the milch cow of Corporations, but contributions out of profits in relief of rates should cease unless both Gas and Electricity Departments hand over an agreed percentage on the capital outstanding.

The Institution—Education and Membership.

As members of a Chartered Institution we regard with satisfaction the increasing use that is being made of the educational facilities provided by its extensive and comprehensive Education Scheme, since the certificates awarded are amongst the qualifications necessary for admittance to membership. In ten years the number of examination candidates has increased from 60 to 417, and we see a steady improvement in the type of applicant who is making good his claim for promotion and general advancement in our ranks. It is imperative that admission to membership should be difficult, as a high standard is far more important than a large membership. Scholastic qualifications are not necessarily a test of capacity, so evidence is wisely required of a candidate's practical qualifications before admission to corporate membership is granted. Examination alone is not enough.

Second International Gas Conference, Zurich.

Since the grant of a Royal Charter in 1929, the Institution has endeavoured each year to include in its normal and progressive programme of work, something of unusual importance. Thus, in 1930, the Institution convened the First International Gas Conference in London, whilst during the year of my successor the Second International Gas Conference will be held in Zurich, under the auspices of the International Gas Union and the Presidency of Herr Fritz Escher, of Switzerland, whose sterling qualities we admired and whose friendship we enjoyed when he joined the British party in its visit to Canada and the United States of America last year.

The Programme of the Conference, already circulated to members, shews that certain member Nations of the Union are to present some valuable Reports, which will summarize and contrast the differences in the practice of gas manufacture, distribution, utilization, and administration in the many countries belonging to the Union. It is to be hoped that the Engineers and Administrators of Gas Undertakings in Great Britain will avail themselves of this unique opportunity of being present at the Conference and of participating in the discussions on the Reports to be presented.

On many occasions the Presidential chair of The Institution of Gas Engineers has been held by men of great prominence in the Engineering and Scientific world. Whilst they presented academic addresses of which you will always have a treasured memory, I have endeavoured to place before you my view of the Industry as it appears to me to-day and about which I have no misgiving. Virile and progressive, it will continue to play its part as one of the greatest of our truly National Industries.

New Members of the Institution

On Tuesday, May 29, the following were elected to hon. membership, membership, associate membership, and associateship of the Institution:

HONORARY MEMBERSHIP.

The Presidents (*ex officio*) of the Union Internationale de l'Industrie du Gaz and of the Gas Associations of America, Australia, Austria, Belgium, Canada, Czecho-Slovakia, Denmark, France, Germany, Holland, Hungary, Italy, Japan, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, and Yugoslavia.

MEMBERSHIP.

Bennet, Harold Edwin, M.C., Managing Director, Alder & Mackay, Ltd.

Brett, Alfred Ernest, Engineer and Manager, City Council Gas-Works, Cottesloe, Johannesburg.

Bullwinkle, George Royall, Works Engineer, Vauxhall Station of the South Metropolitan Gas Company.

Campbell, Arthur Fred, D.Sc., Technical Director, Lancashire Tar Distillers, Ltd.

Gardner, William Temple, Director, The Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd.

Harris, Alfred Thomas, Engineer, Manager, and Secretary, Great Wigston Gas Company.

Harris, Arthur William Joseph, B.Sc., *Institution Diplomé in Gas Engineering* (*Manufacture*), *1st Class*, 1933. Technical Assistant, Tottenham and District Gas Company.

Hawes, Frederick Oliver, *Institution Diplomé in Gas Engineering* (*Manufacture*), *1st Class*, 1933. Technical Assistant, Tottenham and District Gas Company.

Huggett, Percy Richard, Engineer, Manager, and Secretary, Brightlingsea Gas and Coke Company, Ltd.

Jeffrey, John Salmon, Director, The Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd.

Kemp, Stanley George, Engineer and Manager, Quorndon and Mountsorrel Gas, Coke, and Coal Company.

Millen, Ralph, Manager, Provan Works of the Glasgow Corporation Gas Department.

Sutherland, Andrew, Engineering Assistant, Tradeston Works of the Glasgow Corporation Gas Department.

Thompson, Marcellus T., Director and Joint General Manager, Drakes, Ltd., Halifax.

ASSOCIATE MEMBERSHIP.

Bath, Dennis Jack Owen, Junior Assistant Engineer, Hampton Court Gas Company.

Campbell, William Christie, Assistant Engineer and Manager, Helensburgh Town Council Gas Department.

Charnley, Frank Samuel, M.Eng., Clerk of Works, Liverpool Gas Company.

Foulds, Robert Whalley, Shift Engineer, Southport Corporation Gas Department.

Gaskill, Malcolm Sinclair, Chief Operating Engineer, West's Gas Improvement Company, Ltd.

Gledhill, Wilfred Moore, Assistant Engineer, Stirling Gas Light Company.

Hulse, George, Technical Assistant, Cleethorpes Gas Company.

Jolly, Frank Houghton, B.Sc., Shift Engineer, Blackpool Corporation Gas Department.
Kay, Donald Wyatt, B.Sc., Technical Assistant, Salford Corporation Gas Department.
Lambie, David, Technical Assistant, Coatbridge Gas Company.
Laws, Donald Bowmaker, Chemist, Sunderland Gas Company.
Merryweather, Norman Hadley, Technical Assistant, Stockport Corporation Gas Department.
Nicholls, Frank Harold, M.Sc., Second Assistant Engineer, York Gas Company.
North, Albert Victor, Technical Assistant, Dudley, Brierley Hill and District Gas Company.
Speers, John Alexander, B.Sc., Technical Assistant, Preston Gas Company.

ASSOCIATESHIP.

Bellamy, Frederick Burt, Outside Superintendent, Jersey Gas Light Company, Ltd.
Chester, Reginald Percy, Chairman and Governing Director, Donald Macpherson & Co., Ltd.
Fox, William Morland, B.Sc., Technical Assistant, W. J. Jenkins & Co., Ltd.
Handy, John Percival Charles, Engineering Assistant, São Paulo Gas Company, Ltd., Brazil.
Hayes, Sidney William, Superintendent, Wandsworth and District Gas Company.
Hibbs, Tom, Works Superintendent, Mossley Corporation Gas Department.
Hill, Henry Rowland, B.A., Manager, Gas Fire Department, Bratt, Colbran, & Co. and the Heaped Fire Company, Ltd.
Parry, Ernest, Commercial Manager, Oldham Corporation Gas and Water Departments.
Reeve, Cyril George, Assistant Chemist, Hornsey Gas Company.
Sharman, Ernest William, Technical Manager, the British Gas Purifying Materials Company, Ltd.
Smirles, William Nelson, B.Sc., Research Chemist, Industrial Research Laboratories, City of Birmingham Gas Department.
Waller, Frederick Bernard, Assistant Engineer and Manager, Alloa Corporation Gas Department.

President's Luncheon

The President's Luncheon was held in the Ballroom of the Savoy Hotel, there being an attendance of nearly 200.

The PRESIDENT, proposing "Our Guests," said he greatly appreciated the honour that so many had accepted his invitation to the luncheon. There was no doubt, continued Mr. Tarratt, that the Gas Industry to-day was better managed than at any period of its long history. Those coming into the Industry were far better educated not only on the engineering side but on the commercial and accountancy sides than their predecessors had been, and that was essential because the future of the Industry depended so much upon the younger men who were coming into it. The trouble too often was that people thought their sons never grew up. His own view was that the youth of this nation was wonderful. They were morally sound and they should be encouraged and given responsibilities. Coupling the toast with the name of the Rt. Hon. J. R. Clynes, the President said that Mr. Clynes' connection with the Gasworkers' Union and kindred Unions had been unique, and the Industry had always had a very great respect for him.

The Rt. Hon. J. R. CLYNES, responding to the toast, said the list of names of those present with which he had been supplied gave him a very chilling reminder of a personal experience which he had at the General Election in 1931, for the first name on the list was that of Mr. Alan Chorlton, M.P., the man who beat Clynes at the General Election. He had already personally congratulated Mr. Chorlton on a previous occasion in the proper way, and he could now only express the hope that Mr. Chorlton would continue to do the job nearly as well as his predecessor. [Laughter.]

Continuing, Mr. Clynes said he could claim a nodding acquaintance with the Gas Industry and that arose from the fact that when he was 22—some 43 years ago—he became an official of the then Gasworkers' Union, which, although it had since changed its title, still retained as a very large section of its members many thousands of employees in the Gas Industry. During his acquaintance with the Industry there had been great developments—not, perhaps, unsprinkled with certain irritants associated with the competition from electricity—concerning which there might be ground for grievance on the part of the Gas Industry as to certain Parliamentary action taken on occasion in relation to the two industries. However, this was not the occasion to discuss that matter, and therefore he would take the opportunity of congratulating the men who were associated with the Gas Industry in its higher reaches on being the cause of the great development of the Industry during the past 15 or 20 years.

The fact that he had been invited to this luncheon was some indication that those responsible for the management of the Gas Industry were willing to meet on equal terms the men who happened to represent the workmen in their employ. After all, the human side was all-important and he could not recall any occasion when he had had to meet the employers in the Industry in connection with the settlement of differences when they had set aside the human factor or when they had refused to listen to reason. [Applause.] In the course of some further remarks, Mr. Clynes contrasted the willingness of employers to-day to discuss conditions with their employees with the difficulty there was 30 or 40 years ago of even obtaining access to the employers. With this change on the part of the employers there was a greater ability on the part of employees to see the difficulties of the employers and understand their problems.

Mr. W. MACNAB (President of the Institution of Chemical Engineers), proposing "The Institution of Gas Engineers," said he well remembered in the early eighties the scare produced in the minds of many holders of shares in gas companies when electric lighting began seriously to compete with gas. He felt it must have been largely due to the efforts of the Institution that the gas companies were enabled to meet the changing circumstances and find outlets for their products. Rule-of-thumb practices in their industries were rapidly disappearing, and more and more manufacturing processes were being closely studied and carried on with great scientific control. In this connection the work which the Institution of Gas Engineers was doing to foster the education and training of young men to become gas engineers and to develop an increasingly high standard of efficiency was all to the good, and reflected great credit on the Institution. Special praise was due to the admirable and widespread character of the research work which the Institution was carrying out and encouraging in connection both with the uses of gas and with its manufacture. It was with great pleasure that he proposed the toast of the Institution and coupled with it the name of Mr. C. Valon Bennett, the President-elect.

Mr. C. VALON BENNETT, responding, said it was a special pleasure to reply to the toast because the proposer of it was connected with an Institution allied to the Institution of Gas Engineers. The Institution of Gas Engineers was founded in 1863, and he believed it was more active and more alive to-day than it ever had been. In another 29 years it would be attaining its centenary; and whatever the circumstances might be in 1963, one thing that was certain—that the Institution would be alive and, no doubt, still more active. Referring to the comments in Mr. Tarratt's Presidential Address as to the suggestions which had been made concerning a single organization to embrace all the national bodies in the Gas Industry, Mr. Bennett said he agreed with the views of the President. He did not think it would be a wise step, though the Institution would always be ready to co-operate with any association provided it was felt that by so doing the aims of the Institution and the greater efficiency of the Gas Industry would be secured.

Mr. JOHN E. COWAN, J.P. (Chairman of the Newcastle-on-Tyne Gas Company), proposing the health of the President, said that Mr. Tarratt had succeeded two eminent members of his profession when he became Chief Engineer of the Newcastle Company—viz., the late Mr. Doig Gibb and Mr. Thomas Hardie. Both these gentlemen had left Newcastle to take up more important positions in the profession, Mr. Gibb becoming Chief Engineer to the South Metropolitan Gas Company and Mr. Thomas Hardie Chief Engineer to the Gas Light and Coke Company, the largest gas undertaking in the world. As Chairman of the Company, said Mr. Cowan, he had a good deal to do with Mr. Tarratt's appointment; and he wished to take the oppor-

tunity of saying on behalf of his colleagues on the Board and himself that never for one moment had they regretted the appointment they made. [Applause.] Mr. Tarratt had carried out his duties with that tact, courtesy, and ability which he had shown during his year as President of the Institution. Speaking from information which he had obtained independently, he said he gathered that Mr. Tarratt had carried out his Presidential duties in a manner which had upheld the honour and prestige of the Institution, and he had also carried out with success the additional and specially arduous duty of leading the important delegation to Canada and the United States.

The PRESIDENT, acknowledging the toast, said he greatly appreciated the fact that this toast had been placed in the hands of the Chairman of his Company, because it was owing to the goodwill that existed between the Chairman and Directors of the Newcastle Company and their officials that he had been able to undertake the duties of President at the expense of the sacrifice of a considerable amount of the Company's time. He acknowledged the manner in which his staff had supported him. When he returned from the trip to Canada and America he had nothing but admiration for the excellent way in which they had carried on.

DISCUSSIONS ON THE PAPERS

Our report of the Papers appeared in our First Institution Number, and the following is a full report of the Discussions which took place upon them. Papers and Discussions are summarized on earlier pages of this issue in a running account which gives the consecutive story of the whole Meeting.

Aspects of Benzole Recovery and Refining

By S. W. A. WIKNER, F.I.C.,

By-Products Works Manager, Newcastle-upon-Tyne and Gateshead Gas Company,

AND

B. RICHARDSON,

Technical Superintendent, Newcastle-upon-Tyne and Gateshead Gas Company.

Col. W. M. CARR (Stretford): This paper, coming as it does at the present time, is of inestimable value. It is, I think, essential that we should endeavour to obtain the maximum that we can in the shape of residual yield, because only by that means can we get the lowest net cost of coal and eventually the lowest cost of gas. My experience of benzole recovery on what I would like to call the maximum scale is limited to the last two years, but there are one or two interesting points in the paper which I should like to discuss. The authors' experience of no trouble with deposit in the washer or preheater when using gas oil for benzole washing does not accord with my experience at Stretford, where gas oil was used during the first eleven months' working of our benzole plant. Good results were obtained for the first three months, during which period the average wash oil losses amounted to 1 gallon per 26·2 gallons of benzole. After three months' working, trouble was experienced with heavy sludge deposits, and formation of oil-water emulsions in the storage tanks feeding the washing plant—*i.e.*, debenzolized oil tanks. At the end of six months' work heavy deposits of a pitch-like substance came down in the scrubber washer, and the efficiency of the heat exchanger began to fall rapidly, and on opening the heat exchanger it was found that the tubes were covered with a scale of carbonized oil as much as ¾ in. thick in places.

The analysis of the oils at the commencement of working and at the end of six months' working were as follows:

—	New Gas Oil.	Gas Oil after Working Six Months.
1	2	3
Specific gravity at 15·5° C.	0·850	0·862
Viscosity (Redwood) at 60° F. (secs.)	44	58
Distillation—		
Initial boiling point	227° C.	140° C
260° C.	15·5 per cent.	14·5 per cent.
270° ,,	31·0 ,,	28·5 ,,
280° ,,	46·0 ,,	42·0 ,,
290° ,,	59·0 ,,	56·0 ,,
300° ,,	78·5 ,,	76·5 ,,
310° ,,	80·0 ,,	89·0 ,,
320° ,,	87·0 ,,	84·0 ,,

The circulated oil after six months' use contained a black slimy substance held in suspension.

We are now using a spindle oil for benzole washing, and after some six months' use have experienced none of the troubles as when using gas oil. The cost of this oil is almost twice that of gas oil; it is nevertheless cheaper in working, as the make up oil required only amounts to one gallon per 90 gallons of benzole—that is, less than one-third the quantity of gas oil.

The analyses of fresh spindle oil as compared with spindle oil worked for six months are as follows:

—	New Spindle Oil.	Spindle Oil after Working Six Months.
1	2	3
Specific gravity at 15·5° C.	0·889	0·889
Viscosity (Redwood) at 60° F. (secs.)	46	48
Distillation—		
Initial boiling point	339° C.	146° C.
350° C.	2·5 per cent.	3·5 per cent.
375° ,,	40·0 ,,	42·0 ,,
400° ,,	65·0 ,,	64·5 ,,

There does not appear to be any deterioration in the washing efficiency of the spindle oil after six months' use, and no trace of sludge or emulsion has so far been detected. A recent test gave an extraction efficiency as follows:

Benzole at inlet to washer	2·72	galls. per ton coal carbonized
Benzole at outlet of washer	0·33	,, ,, ,, ,,
Extraction efficiency	87·7 per cent	,, ,, ,, ,,

The following comparison of results shows that the physical capabilities of the spindle oil compare favourably with gas oil:

—	Gas Oil.	Spindle Oil.
1	2	3
Gas temperature, inlet washer	63° F.	57° F.
,, ,, outlet washer	62° ,,	56° ,,
Oil ,, inlet washer	65° ,,	65° ,,
Gas flow per hour, max.	120,000 cu.ft.	145,000 cu.ft.
,, ,, ,, min.	60,000 ,,	95,000 ,,
Oil ,, ,, max.	1,300 galls.	1,500 galls.
,, ,, ,, min	500 ,,	500 ,,
Viscosity wash oil at 60° F. (secs.)	44	46
Specific gravity wash oil at 15·5° C.	0·850	0·889
Benzole distillation at—		
70° C.	..	..
80° ,,	5·0 per cent.	5·5 per cent.
90° ,,	67·0 ,,	67·5 ,,
100° ,,	84·0 ,,	85·0 ,,
110° ,,	88·5 ,,	89·0 ,,
120° ,,	91·0 ,,	91·0 ,,
Specific gravity of benzole at 15·5° C.	0·883	0·881
Solvent naphtha distillation at 90° ,,	*Nil*	*Nil*
,, ,, ,, 180° ,,	5·0 per cent.	4·5 per cent.
Specific gravity of solvent naphtha at 15·5° C.	0·868	0·884
Benzole extracted per ton of coal carbonized	2·69 galls.	2·4¼ galls.
Wash oil losses	1 gall. per 26·2 galls. benzole	1 gall. per 90 galls. benzole

As extraction tests have shown the spindle oil to be as efficient as the gas oil, it appears that the higher benzole yield when using the latter is due to gas oil fronts being carried into the benzole fraction.

The authors give a very useful table of costs, but I sometimes think it is dangerous to give these costs because the Government is always thinking of taxing one thing or another, and if it sees these published costs it might think the Gas Industry is making a little profit out of benzole and that therefore it ought to do away with the tax. I have prepared an analysis of costs of my own plant for the first year's working which show a total cost of rectified spirit of 6·869d. per gallon, which, of course, at the present price of benzole leaves a useful net profit, and this assists the

price of gas; therefore I hope the Government will take a kindly view and remember that the money is going back to the gas consumer.

Effect of Cracked Residues.

Mr. J. S. Thorman: I should like to add my thanks and appreciation to the authors for their valuable contribution on benzole recovery and refining. Gas-works undertaking this profitable recovery are increasing rapidly in numbers, and we have every reason to believe they will continue to increase. I feel in view of the very general experiences of heat exchanger troubles due to sludging of gas oil that Mr. Wikner has been happy in his experience. I am interested to notice that the authors ask whether the modern practice of adding a proportion of cracked residues to the gas oil by the petroleum distillers has any bearing upon the problem. At Southall we have certainly thought this to be the case, particularly so because from 1926 to 1929 we had in circulation for benzole absorption an old stock of straight-distilled gas oil and sludging troubles were negligible, and, except for make-up, no oil was changed. In the last five years gas oil containing cracked residues has been used and sludging has been rapid, reducing the efficiency of the heat interchangers, and the need for changing wash oil has been frequent. I must add that during the two periods the type of carbonization plant in use has not been the same, and this has some influence on the behaviour of the wash oil. At Southall electrical detarrers have been recently installed which remove the whole of the tar fog. I am very glad to hear that the complete removal of tar fog will prevent sludging of the gas oil.

The question of the temperature of wash oil in the scrubber or washer—a point which is always mentioned in reference books but insufficiently stressed—has been raised by the authors, and I am glad to see that they emphasize it. One of the most frequent causes in practice of incomplete oil scrubbing is insufficient cooling to bring the temperature of the oil down to within about 20° F. above that of the gas. Outlay on cooling plant to obtain this is often better repaid than the provision of additional heat exchangers, because the cooler the oil—down to the limit mentioned above—the less oil is required to be circulated and heated and cooled. We feel that even after 18 months' working to the new specification of the National Benzole Company—giving the gum formation test instead of acid wash test—the last word has yet to be said about the relative merits of inhibiting and of strong acid washing. Some types of crude benzole, especially some vertical crudes, may be still advantageously rectified by the older method, especially when no further treatment for sulphur removal than that of removing thiophene is needed.

Mr. Wikner is the first chemist to carry out on the works scale the chemical method of removing carbon disulphide by the methanol process. Last year we were impressed with the results of his laboratory experiments. The reasons then that prevented our adopting the process were two: (1) The long period of agitation needed to complete the reaction, which, if added to the ordinary washing period would have reduced our throughput too much; (2) being left with unsaleable sodium xanthate, or crude carbon disulphide. The first objection has since been lessened, especially if forerunnings are first cut and these washed instead of the whole of the benzole, but the second still remains. The advantage that the process offers over fractionation, even assuming the most efficient column practicable (*e.g.*, the Beckton new column, which is remarkably efficient) is that there is a complete recovery of the low boiling paraffins, which cannot be separated from CS_2 by fractionation however efficient, and so the yield of motor benzole is higher. Against this must be set the probable greater cost of disposing of xanthate or crude CS_2 on the works than of disposing of forerunnings. Sodium xanthate would be difficult to dispose of, it is an aqueous solution and on heating breaks down giving some H_2S. Carbon disulphide could possibly be disposed of in a manner similar to ours for destroying forerunnings, but very special precautions would be needed.

A Word for Creosote.

Mr. F. Firth (Leeds): While we have had quite a number of papers in recent years dealing with benzole recovery from the economic, scientific, and working points of view, the authors of the present paper are to be commended on the interesting manner in which they have been able to serve up this much discussed subject, and bring forward original matter and experience which will be most useful to those of us who are recovering benzole from town gas.

In the section dealing with wash oil, the authors express a preference for gas oil which would appear to be justified judging by the extremely good recovery results obtained, and the singular freedom from emulsion and thickening of oil troubles they have enjoyed. Can this state of affairs be entirely due to the use of gas oil?

As users of creosote for benzole recovery, we find it very satisfactory, and, as shown by the authors, it has a 53% greater absorptive power for benzole than gas oil, with all the advantages of working which this statement conveys, such as the relatively less oil to be circulated and the consequent general saving in steam, &c.

A point which merits consideration in view of the present difficulties of finding markets for our products is that we are producers of creosote while gas oil is a foreign product. I do not like the idea of putting spent gas oil into the tar well for the good reasons given by the authors—that of causing deposition of insoluble pitch in the tar or, if left floating on the liquor, the potential troubles in store for the ammonia plant.

Naphthalene is a real problem where creosote is being used as the washing medium, but even in the paper under discussion the 1·6 to 2 grains of naphthalene left in the gas after the tower scrubbers would be sufficient to cause trouble on the district. The authors have avoided this possibility by a final wash with new gas oil, and the same precautions would have to be taken when creosote is the washing medium.

Total removal of naphthalene from the gas is the only safe way of avoiding district troubles whether benzole recovery is being carried out or not. While admitting that naphthalene removal by washing is the most satisfactory method of preventing troubles on the district, we have been fairly successful in this direction by vaporizing gas oil into the gas stream at the inlet of the holder. The bulk of the oil fogs out of the gas almost immediately, most being deposited and collected in the holder syphon, where it is recovered and used on the carburetted water gas plant.

Some goes on the district as fog, and also the gas is really saturated with the heavy oil, and I suggest it is probably the latter condition which is primarily responsible for our freedom from complaints. With lighter paraffins, while more oil may remain as vapour in the gas, the possibilities of saturation are not as likely.

A reduction in the sulphur content of the gas is a very desirable object and I fully agree with the authors' remarks; and the results we have obtained are in fair agreement with those given in the paper.

A Paying Proposition.

On the economics of benzole recovery, I think it is now generally admitted that it is a paying proposition, especially when compared with the results from a similar capital outlay spent in supplying new housing estates with gas.

The increased revenue to an undertaking from a "new consumer" taking the equivalent of 5% of the total thermal output is a point which cannot be over-emphasized; and where a benzole plant is installed, the difficulty of being able to show a saving in works expenses when the plant is shut down for a period, shows how little the works expenses are increased when benzole recovery is adopted.

On the carbonizing side, in dealing with the effect of types of charges on the composition of benzole, the authors suggest that temperature has less influence than time contact of the gas with the hot walls of the retort. Under the conditions of the heavier charges, is it not possible that, while the combustion chamber temperature may be higher than with the lighter charges, the increase in the rate of gas given off will have a greater chilling effect on the inside walls of the retort and the resultant temperature may be equal to, if not lower than, that existing when lighter charges are being carbonized, and the reason for the higher paraffin content in the benzole where heavy charges are the rule is a combination of low temperatures with reduced time contact?

The authors apparently wash the crude benzole and eliminate "once run" distillations. The reason for "once running" is to save acid being wasted on the heavier fractions, which do not form part of the ultimate rectified products, and which are well known to consume the most acid. Emulsion troubles are also reduced, and, in addition, that tendency, mentioned by the authors, of producing neutral sulphonates when heavy fractions are present, which on distillation liberate sulphur acids and cause trouble, is very much reduced. Unfortunately neutral sulphonates can occur in a "washing" even in the absence of the heavier fractions, but we have been able practically to eliminate this trouble by reducing the time of "agitation" in the acid wash to 20 minutes instead of 2 hours. We carried out an investigation and took periodic samples from a benzole washing during the period of agitation, and we were able to prove that after 10 to 15 minutes' agitation, no further improvement in the wash occurred.

The Inhibitor Process.

We have adopted the "inhibitor" process, and our acid wash consists of 0·5% acid drier and 1·5% acid wash, using

in both cases 82% strength sulphuric acid. This strength we find it necessary to use to remove thiophene—acid strength has considerable influence on the efficiency of thiophene removal. After the acid has been allowed to settle in the washer, water, without agitation, is run into the wash to form a buffer between the acid layer and the benzole. This simplifies the cut, when running off the acid, between the benzole and the washing medium and reduces benzole losses.

I would like to ask the authors if they ever have emulsion troubles after washing, and what precautions are taken to avoid, or deal with, them when they occur?

Having adopted the "inhibitor" process we use the methanol soda method for the removal of carbon disulphide. It may be of interest to give the details of our workings, which are quite different from the procedure adopted by the authors. The crude benzole is "once run," and the fraction up to a boiling point of 77° C. (boiling point as determined in the "Edwards" boiling point apparatus) is collected separately for treatment with methanol soda. This fraction is not acid washed.

In our first experimental washing on the works scale the necessary quantities of methanol and caustic soda in the proportions to give a 4·5 normal solution were introduced together to the benzole forerunnings in the washer, and the whole was agitated for 4 hours. The results were very disappointing, and even after a further 4 hours' agitation the efficiency of carbon disulphide removal, based on the caustic soda used, had only reached 56%.

Then we had further trouble in the washer "take off" pipe when we attempted to run off the methanol soda. Crystallization had occurred, and this blockage was only cleared by dropping a ½ in. pipe into the washer and impinging steam on the obstruction. We have now adopted a procedure which on the last four washings has given us an efficiency of carbon disulphide removal of approximately 80% calculated on a basis of the soda used. The strength of the methanol soda used is 5 Normal.

Our procedure is to run into the washer just sufficient benzole forerunnings which together with the calculated quantity of methanol required for the whole wash, will bring the mixture within the action of the washer stirrer. The percentage of methanol in the mixture at this juncture will probably be about 25% to 30%. The stirrer is started and the necessary quantity of caustic soda is now added, which, after 20 minutes' agitation, is taken into solution. With the stirrer still in action the remainder of the benzole forerunnings to be washed are run into the washer.

After 4 hours, double the quantity of water to that of the methanol used is added to the washer, and agitation is carried on without a break for another hour, the speed of the stirrer being cut down to half during the last ½ hour in order to coagulate the droplets of the washing medium in the benzole and expedite separation.

From experiments made, we find that emulsions are caused by the presence of very fine suspensions of washing media held in the benzole, which only separate out after very prolonged standing, and the reduction in the stirrer speed is an attempt to increase the size of these droplets and increase the rate of separation.

The crystal deposits in the "run off" pipe have been eliminated by the simple method of running off a couple of gallons of the washing two or three times during the progress of a washing, and returning this to the washer.

The authors are to be commended on the initiative shown in recovering methanol from spent methanol, but I would suggest that co-operation between a few works, with one works undertaking the recovery of methanol from the spent material, has much to commend it.

I would like to congratulate the authors on a very useful contribution to the Transactions of this Institution.

The Wartime Demand.

Dr. R. Lessing: When during the war the necessity arose not for economic reasons but for reasons of national defence to wash gas for its benzole and particularly its toluol content, some of us who were engaged in this particular branch took a great interest in it, and we were rather hopeful that at the conclusion of the war this method of dealing with gas would be continued for economic reasons. Therefore, we were rather disappointed to find that there was no particular willingness or readiness to carry on the valuable work which had been done and to take advantage of the valuable lessons, as far as they went, which had been learned during the period of stress. However, during recent years it has become economically more important, and not only the need but the advantage has been demonstrably stressed that by extracting benzole from gas not only do we support the coal industry by replacing the therms extracted from the coal with the gas, but we also meet the liquid fuel requirements of the country from home-produced sources. To that extent this development is a very important one, and to-day there must be between 120 and 150 benzole plants in the country which carry out this work. Therefore, now is the time for technical improvements to achieve what has begun with a relatively coarse way of dealing with the matter and bring it to a higher degree of perfection. The authors have shown how this can be done; and not only that—they have even gone beyond the extraction of the benzole and its refining and are now employing this new method of cleaning benzole by means of alcohol.

Use of Alkaline Cellulose.

The reaction which the methyl alcohol or methanol, together with the soda, brings about with the carbon disulphide is very interesting, and I am personally interested in it because during the war I employed a similar reaction for the production of xanthate for the same purpose. Alcohol was at that time out of the question, and methanol was not yet produced in commercial quantities. The substance that I then recommended was cellulose, and the reaction is practically the same as that which is used in the artificial silk process, called the viscose process. Chemically there is not a very great difference in it, and it might have been worth while for certain purposes and for certain phases of this process to revert to the investigation, even if not to the extent of taking up the old process. It was carried out by using alkalinated cellulose—*i.e.*, cellulose treated with caustic soda and then stirred in exactly the same way as the methanol-soda is employed to-day. That process, however, was not proceeded with because the carbon disulphide removal efficiency only reached 60 to 66%, but I believe I am right in reading the figures of the present paper in saying that that is what is aimed at to-day with a benzole containing 1·5% of sulphur. Any higher than that exceeds the amount of sulphur permissible in the residue.

Fractionation Efficiency.

There is one other point which relates to the very interesting figures and results given by the authors concerning the performance of the ring packed stills which they employ largely, as most other benzole plants do, for the distillation of their products. In this connection a good deal has been said before, but very little reliable information has definitely been given. Therefore, it may be of use to those who are running benzole plants if I add one word on the size ratio of rings to still column which should be employed. On turning to the description of the methanol recovery still it will be found that the results are very excellent. The reason for this is that the correct ratio has been employed—namely, 1½ rings for a 2 ft. 8 in. diameter column—*i.e.*, the diameter of the ring is practically about one-twentieth of the diameter of the column. If we look at the other distillations in which ring-packed columns are used, referred to by the authors, and particularly the low-pressure one, we find that larger rings relative to the diameter of the column were used and in consequence the curves relating to the laboratory distillation in my view do not give as close a cut as would have been obtained if smaller rings had been used. This may be a small tip to those who are in the habit of using these rings.

Sludging of Wash-Oil.

One final word on the question of the sludging of the wash-oil. A great deal of work has been done in the past in that connection, although not exactly of a highly scientific order, and a good deal of it by the coke oven people in the early days of benzole washing; but I think the time has now come when the various oils which are available for this purpose should be examined on proper comparative lines in the laboratory in the first instance. It is my view that this subject should be recommended to one of the Research Committees of the Institution. I should not like to conclude, in spite of the President's injunction, without thanking the authors for their very interesting paper and particularly for the way in which they have given the details—dimensions, rates of time contact, &c., which are absolutely essential in order to consider a process of this kind.

Mr. H. Hollings (Gas Light and Coke Company), asked by the President to speak, said: I had no intention of speaking, but I cannot ignore this invitation. On reading this very interesting paper one point which interested me particularly was the reference to steam consumption in the plants at Newcastle, and it occurred to me that greater economy might have been obtained if that low-temperature scheme had been used in pre-heating the oil going to the still rather than in attempting to use it for the distillation process itself. I refer to this because it occurs to me that in connection with the more economical recovery of benzole on gas-works the one point which will repay more detailed study by those operating these plants is this question

of steam consumption and proper heat interchange on the plant.

References to the removal of sulphur from gas are, of course, of the greatest importance. Reference is made to the possibility of using active carbon for taking out the last traces of carbon disulphide. That is a matter, of course, in which my Company is interested, and perhaps I may be forgiven if I remind the meeting of what is being done at two of the works of the Gas Light and Coke Company, where active carbon is used for benzole recovery. Simultaneously with the removal of the benzole, between 70 and 80% of the sulphur compounds in the gas are removed, and the sulphur content of the treated coal gas is reduced to a matter of 6, 7, or 8 grains, a figure which will compare very favourably with the results obtained by processes which have been designed specifically for the purpose of removing carbon disulphide.

Effect of Sulphur Contents.

Mr. A. L. Holton (Manchester): I should like to ask a question or two from the authors of this valuable paper. With regard to wash-oil, sludging has been dealt with and at Manchester we feel that the tar fog has something to do with it. We have been fairly successful in eliminating tar fog and up to the present we have had no trouble with sludging. I should like to suggest to the authors that there comes another trouble in the course of time—that the sulphur contents in the wash-oil increase to a very large extent and have their effects on the benzole recovery. The sulphur content of the benzole is a factor that requires very careful watching, and personally I am changing the oil at one of the works to the oil to which Col. Carr has referred solely for this reason.

One point with regard to the authors' costs is that you will have noticed they charge a certain amount for coal. I suggest that the more accurate way would be to judge for yourselves what a fair price per therm is and then to charge your process up with so much per therm rather than simply give it its coal equivalent which takes no account of any capital costs. The steam used has been referred to and I suggest to the authors that their figure is somewhat on the high side as compared with very many works.

Can the authors give me any idea as to how we can get away from the abominable smell from crude benzole? I daresay many of you, like myself, have been experimenting with the use of crude benzole on both commercial vehicles and private cars, and I definitely say that it can be successfully used for that purpose. In fact, in one of the motor races recently the man who came in third used Manchester crude benzole. [Laughter.] People have got used to the smell of petrol, but they are not used to the smell of crude benzole, and if you get behind such a vehicle people will tell you that there is a gas escape. If, therefore, we could get rid of this "gas escape" smell I am certain there is a big field for crude benzole. Two quite good cars have been using crude benzole now for 18 months without the slightest trouble except the so-called "gas escape."

The Authors' Reply.

Mr. Wikner: We think it would be better altogether to give the reply to the discussion in writing. That will be fairer to everybody; some of the things that have been mentioned are very interesting and want looking into, but Mr. Richardson and myself are delighted with the response that has been given to the paper which has very well repaid us for the trouble we have taken in connection with it. I do not propose to refer to anything except this, because it is the last point mentioned and therefore is fresh in my mind. Mr. Holton told us about using crude benzole, but we think it was rather a shame the driver he mentioned as using crude benzole should have come in third, because he would probably have come in first if he had used refined benzole. [Laughter.] This question of smell, however, we think is probably one of the difficulties with the inhibitor. The benzole is getting stronger in smell, but I think it is something we shall have to put up with in view of the financial benefits which come from the use of the inhibitor process.

Mr. Richardson, in the course of a few remarks by way of reply, said: I also am very gratified with the reception which has been given to our paper, and I am only sorry that there is not time for us to reply in detail to the discussion. There is one thing I should like to refer to, however, and that is the wash-oil. Col. Carr's experience with gas oil is exactly the same as the experience we have had with creosote oil. Our experience with that oil was that after it had been used for a short time it caused very considerable emulsification and sludging in the pre-heaters and we had to change this oil at very frequent intervals. On the other hand, our experience with gas oil has been entirely the reverse. I have been using gas oil for 18 months in a benzole plant, and we have had no trouble with emulsification and no trouble with sludge formation, and the oil is apparently to-day giving the same efficiencies of benzole extraction as it did when it was first put into circulation. The matter is really somewhat puzzling, but I think the reason is to be found in the fact that the gas oil which is being produced to-day contains a certain amount of cracked products which tend to give trouble in circulation in the benzole plant.

Town Gas in the Steel Industry

By Dr. H. ALEX FELLS, B.Sc., A.I.C., A.M.I.Min.E.,

Chief of Fuel Research Department, The Sheffield Gas Company.

The President: I am sure you greatly appreciate the very excellent paper by Dr. Fells. It must have taken an enormous amount of time to prepare, because there is a great deal in it which will certainly be very useful for reference later on. I will ask Dr. Walter, of Birmingham, if he will kindly open the discussion.

Dr. C. M. Walter (Birmingham): I should like first of all to congratulate Dr. Fells on the most excellent paper he has given us and particularly on that portion of it which deals with the damage caused by scaling and decarburization, on which such a large amount of work has yet to be done. I think, as he pointed out in the paper, we all appreciate that even with a neutral atmosphere this difficulty is a very considerable one, and I can only refer now to difficulties that one finds in hardening and tempering small things like needles and fish hooks, where even in a neutral atmosphere the effect of the water vapour present in the products of combustion is a very serious matter. In Birmingham we have done a lot of work with a view to reducing this difficulty, and all sorts of schemes have been resorted to, one of which is purging at low temperatures with raw gas and gas mixtures, and at the present time we are inclined to try the effects of different percentages of CO added to the gas in low-temperature work.

With regard to high-speed steel hardening, I think we all appreciate the importance of the removal of the water vapour in the products of combustion which Dr. Fells is effecting by means of the new process. Reference is made to the use of regenerative furnaces in the steel industry, and the author points out that melting of steel has not yet been given very serious attention so far as high-grade gas is concerned. I should like to ask Dr. Fells if he has had any experience in connection with open hearth furnace work and whether he does not find a great difficulty in using high-grade gas because of the water vapour in the products of combustion owing to the very high hydrogen content. I believe it is customary to mix blast furnace gas with high-grade gas in such proportion as to produce a gas containing a certain percentage of CO in order to bring the calorific value down to about 200 or 250 in order to get the necessary volume sweep, which is so necessary in open-hearth furnaces. That is one of the reasons why high-grade gases have not yet been used to any great extent in steel manufacture.

Recuperation.

Reference is also made in the paper to recuperation both by means of brick recuperators and metal recuperators. While having several features to recommend them, metal recuperators have not been commonly used, and I should like to ask the author exactly what type of metal recuperator he is referring to. Is he referring to the built-in type of metal recuperator—probably of alloy steel or nickel chrome steel—or is he referring to the external metal recuperator such as is very often employed in connection with the pre-heating of air in forging furnaces? Some very interesting figures are given in Tables IV. and VI., and I should be very glad if Dr. Fells could give us some idea as

to the dimensions of the particular furnaces on which these tests were carried out, and also, if possible, the dimensions of the stampings which were heated or the billets from which the stampings were produced.

Another matter referred to is the difficulties of using air/gas proportioning devices, when the air is previously preheated. I take it that the author is referring more particularly to proportioning devices using some form of diaphragm controller, in which case the difficulty of using hot gases would be very considerable. On the other hand, we have found no difficulty in designing a lot of proportioning devices in which mixed gases can be used. The regenerative type of forging furnace is mentioned, and photographs appear in the paper. I should be glad to know whether Dr. Fells has experienced any difficulty owing to disintegration of the brickwork of the regenerators, as, in all probability, hammers used with these forging furnaces would be in the vicinity of the furnaces themselves, and we do find at times great difficulty with the regenerative settings owing to the vibration effect caused by the hammers.

The use of gas for sheet heating is mentioned, and I would like to know if Dr. Fells has experienced any difficulty with the Chantraine type of furnace for this work, because from results I have obtained it seemed an excellent type of furnace for the uniform heating of these sheets. With regard to the tests mentioned in Table VI., I should like to have some details in regard to the size of the furnaces to which these tests refer, and also particulars of the oil and gas burners used in each particular test.

From the Coke Oven Viewpoint.

Mr. G. J. Greenfield (Vice-President, Coke Oven Managers' Association): I do not propose to make any formal comments or even to ask any questions about this paper. But I felt that as it deals with a subject of so much importance to us in the coke oven industry—where we are looking to you gentlemen to help us to dispose of what has become our main bye-product—I thought it would be improper for me to let this opportunity go by without making some remarks. It is quite clear, I think, that town gas has become of great interest to coke oven managers, and it is also likely to be most wanted in large quantities in industrial centres. I do not mean to say that it is not going to be wanted in other centres where it may be consumed purely for domestic purposes. In that respect I cannot refrain from remarking that a modern coke oven plant is nothing like what I may term the ancient coke oven plant, because it is designed to produce gas constantly and to produce gas of a high calorific value. The difficulty with most modern plants is to keep the calorific value low enough to satisfy the gas engineer. In industrial centres steel works are likely to be large and fairly constant users of coke oven gas, and the reason why I particularly welcome this paper is that it helps us to understand the problems of those who are to a large extent our ultimate consumers. It enables us to understand what they are buying and how they are trying to do it. Therefore, together with the other members of my Association, I shall be interested to read the full discussion on this paper, because I think it would enable both the members of my Association and the members of your Institution, who are actively engaged in the production and use of gas in steel works and other large undertakings, to see the development that has taken place. I think that in the long run, just as every gas worker ought to be a salesman of gas, so every coke oven worker—and particularly every coke oven manager—ought to be a salesman of gas—and this paper and the discussion upon it will enable us to talk to those whom I refer to as our ultimate customers and make some remarks which might be useful to them in solving their problems and finding out how to use coke oven gas and other gas in place of other forms of fuel. The paper is interesting to me because it shows how town gas has properties which make it suitable for metallurgy. One gathers that there are some properties which make it unsuitable, but I suppose those who are engaged in selling the gas will be able to gloss over these and concentrate mainly on the properties which are suitable for metallurgy. In that way we can look for a large increase in the consumption of gas for general purposes.

I should like to point out one problem which will arise. In the Gas Industry, as in every other industry, the expression "load factor" is often heard, and naturally in the Gas Industry, as in other industries, the higher the load factor the easier it is to produce and sell this product cheaply. I know in broad outline what the variations are between the summer and winter load and between the day and night load, but your housewife cooks on Sundays as well as on week-days, whereas your steel works shut down on Saturday and start again on Monday morning. Thus, in the case of the industrial supply you will have a very big drop in the load over the week-ends, and particularly so in the steel industry, and without offering you a solution—because I have not one—it is clear that you will require to consider what you will do about it, particularly if you are purchasing gas from a coke oven undertaking with which you are really in partnership. You will have to consider what you are going to do because a coke oven plant is not so flexible as a gas-works plant. It cannot slow down so much at week-ends because the gas is not required. I just throw that out as a remark which may be of use to those who are considering the application of gas to the steel industry. Finally, I should like to thank you for your courtesy in inviting me and the members of our Association to be present to-day.

Indication of a Forward Policy.

Professor J. W. Cobb (Leeds University): This paper is one on which both Dr. Fells and the Sheffield Gas Company are to be warmly congratulated. It is one of a kind to be welcomed as indicating a forward policy in the development of the use of town gas for industrial purposes, although much of what is contained in it is applicable to fuels and furnace work in general. It shows how the gas man can secure a footing with the metallurgist for the benefit of both if he can make his contributions to the questions that arise in such processes as the furnacing of steel. It is to be hoped that the same enlightened practice may become more general, and that such effective collaboration between the gas-works and the industries may become much more general. The manager of any industrial concern ought, so far as it is at all possible, to be able to get the kind of assistance in heating problems which the metallurgist can get from Dr. Fells in Sheffield and Dr. Walter in Birmingham. In these cases the art of salesmanship, though very important, is not enough. It is necessary to render available the technical skill and understanding of a man well trained in combustion engineering and chemistry, who has applied his thought to the particular problem before him. For this purpose, considerable mental elasticity and adaptability are required, in addition to a knowledge of the science of gas engineering. A corps of such men is required in the Gas Industry if the applications of gas are to be much further advanced. It does not exist, but requires to be created, and I am certain that it can be created if young men of scientific training are given a fair opportunity, and if they are not expected to be ready-made experts before they have had the necessary experience in their work.

The paper submitted covers much ground, but I think that in many ways the most interesting part of it is that dealing with the necessity for securing a proper atmosphere in the furnace, and describing the methods which have been adopted with success at Sheffield. As Dr. Fells has indicated, we have been specially occupied with the laboratory study of this aspect of furnace engineering for a number of years at the University of Leeds. This branch of our work has not been in direct association with the Institution of Gas Engineers because, candidly speaking, at the time we started upon it, the interest of the Gas Industry in the subject had not been sufficiently aroused, although its importance was, I think, pretty obvious. This importance is not confined to the steel industry. It embraces many other metallurgical and chemical operations, but the conditions determining the scaling of steel were given first attention.

Smoky Furnace Atmosphere.

Dr. Fells has dealt with some of our results in his paper, but there are one or two other points to which, I think you will agree, I am justified in calling attention. The first relates to the smoky atmosphere from furnaces, which has been too easily accepted as a necessary condition for the prevention of scaling. We made some special experiments on this point. Hydrocarbons were added to the neutral furnace atmosphere in just sufficient quantity to prevent scaling as ascertained by trial. The result was the formation of smoke. The smoke particles were then filtered out of the gases leaving the furnace, which were analyzed, and another atmosphere was made up, as nearly as possible, of the same composition as the exit gases, without smoke particles. This on trial proved to be non-scaling. It was so made quite plain that the prevention of scaling was due to the reducing gases present, and not to the smoke particles, which had exercised practically no effect. That is, a clean gaseous atmosphere containing reducing gases can be relied upon to prevent scaling without the emission of smoke. It is possible that in some furnacing operations the deposit of carbon on the metal may have a beneficial screening effect, as has been pointed out by Mr. Sarjant and others, but on that point I have formed no opinion from first hand observation or experiment.

I would also like to say something to you about experiments which we have had in hand for some time on the influence of the sulphur content of the fuel on scaling. By the gradual addition of SO_2 to the neutral furnace atmosphere, we have demonstrated quite conclusively, and the

same has been done by Mr. Murphy and others for the American Gas Association, that the presence of SO_2 has quite a marked effect in increasing scaling. The scale produced with an amount of SO_2 (0·2%) corresponding with an average unpurified coal gas or coal was, at 1,000° C., roughly one and a half times as much as that produced from a purified coal gas containing 25 grains of sulphur per 100 c.ft. I will not say more at the present time about the results, but they are of a very interesting character. They may have an important bearing on the economic position of a purified coal gas in furnace work as compared with other fuels, and on the interesting question of how far it is desirable to distribute coal gas (including coke oven gas) for industrial purposes in the unpurified condition. It is necessary to keep in mind that sulphur may exercise a deleterious influence on the metal, apart altogether from scaling, and in some cases very much more important. I am also investigating this side of the question in collaboration with Mr. Preece, the Assistant Lecturer in Metallurgy in my Department. The survey is being extended to include special steels, and a selection of these has been supplied to us by Messrs. Hadfields, Ltd., through the good offices of Mr. R. J. Sarjant.

Rolling Mill Plant.

Mr. J. E. White (Newcastle-on-Tyne): I would like to congratulate Dr. Fells upon the paper which he has presented before this Institution. It is of particular interest to me because of the similarity which exists between the industries of the Sheffield district and the north-east coast. In this respect Dr. Fells' work on rolling mill plant is of special interest, as in Newcastle we have both ferrous and non-ferrous mills operating on town gas. In each case, however, the problem has been tackled from a different aspect, and Dr. Fells' Paper has thus given me an opportunity of arriving at a conclusion which for some time has given cause for thought. In the Newcastle rolling mill furnace the heat leaving the furnace in the form of waste gases is utilized for the preheating of the incoming air for combustion. In this manner we have been able to obtain a consumption of 3,377 c.ft. per ton on a weekly throughput of 430 tons of steel sheets and plates. In Table II., Dr. Fells reports on a furnace handling 390 tons per week in which "no attempt at waste-heat recovery is made, the preheating of the incoming load being the only form of heat recovery employed." In this case a consumption of 4,108 c.ft. per ton is obtained; in short, the full heat recovery by air preheating can account for approximately a 20% decrease in gas consumption. Dr. Fells later mentions that the latest type of billet furnace makes use of both load and air preheat, and it would be interesting to know if the decrease in consumption in any way approaches the percentage which I have stated.

We have recently completed an installation in connection with the non-ferrous rolling industry, the furnace having been converted from solid fuel to gas firing by the use of British Furnaces low-pressure burner equipment. There is no form of heat recovery other than the use of the warm waste gases to dry the brass sheets after withdrawal from the pickling tanks. Here the heat input in B.Th.U. by gas is exactly one-fourth of the coal heat input. Under these conditions week by week 78,000 c.ft. of gas are doing the same work as that previously performed by five tons of coal.

There is no doubt that the process under consideration decides to a very large extent the nature of the furnace to be used. Our experience is that where very frequent furnace door openings are involved, there is little if anything to be gained by elaborate heat recovery systems. If, however, the process is of a continuous nature such as the annealing of large steel castings or the carburizing of mechanical components, then unquestionably some form of heat recovery should be used. The use of such heat recovery will bring the price of gas to within the possible range of the majority of British gas undertakings. There is, for example, no reason why the price charged for gas for the process of carburizing and re-heating after carburizing should be less than 4d. or 5d. per therm. Dr. Fells, like myself, is in close competition with cheap fuels; for in each district solid fuel is available at works railway sidings at approximately 0·6d. per therm and fuel oil under similar conditions at 2½d. or less per therm. The industries of the two districts are such that while there are openings for the generally accepted uses for gas, there are enormous possibilities in certain industries which are capable of consuming vast quantities of heat, providing that it can be supplied at competitive prices.

The possibilities open to the Gas Industry generally at a normal price of, say, 6d.-8d. per therm are considerable, especially in the commercial uses. There is a very considerable field for development where gas is available at approximately 4d. per therm, but in really cheap gas, that is between 2d. and 2½d. per therm, there are possibilities which are so great that any ordinary commercial firm having such possibilities would consider itself very favourably placed. Fortunately, however, those industries to which gas is competitively attractive at 2d. to 2½d. per therm are situated in areas where, generally speaking, coke oven gas is available. Circumstances vary so much that it is little short of impossible to give a precise opinion on charges for industrial gas; I believe that local conditions only can decide this factor. It is, however, the basis of the whole of industrial gas business.

Possibly many who have read Dr. Fells' Paper have, by simple arithmetic, arrived at the conclusion that many of the processes described therein are being handled by gas at 1s. per 1,000 c.ft. and have therefore considered the possibilities of industrial gas as outside the scope of their undertakings.

The Motor Industry.

I venture to suggest that the Gas Industry should carefully consider the methods of the motor car industry. Anticipatory costing has enabled men like Sir Herbert Austin and Lord Nuffield to offer to the public cars which are double the value and half the cost of the models which they were offering ten years ago. I believe that when the Gas Industry has arrived at a fuller appreciation of the relationship between the true economic value of gas fuel and the industries of the district, it can, by the same costing considerations, do the same big business as the motor industry which, by its ready appreciation of what the public wants and what the public can afford to pay, has developed almost beyond recognition. The same applies to gas in industry.

I have in mind a gas undertaking in north-eastern England which, without the aid of coke oven gas, is selling gas to the iron and steel industry at 1s. 2d. per 1,000 c.ft. for nine months of the year and at 1s. 3d. per 1,000 for the remainder of the year. The difference between manufacturing cost and selling price may only be 2d. per 1,000 c.ft., but I suggest that for an annual load of 30 millions it cannot be regarded as anything other than good business, especially when it is remembered that no charges can be reasonably placed against this extra consumption other than the coal used and a little extra labour involved in the handling of the same. If the Gas Industry is to show any marked progress in its sales during the coming years, it will be through the medium of specially priced gas for industry. Sheffield, and other companies have, by their yearly results, proved beyond question that the cheap industrial gas load is well worth while the effort made to secure it.

The Sheffield Company are to be congratulated on the courageous manner in which they have tackled the industrial gas problem. It would seem that they, together with the industries of Sheffield, have taken to themselves a now famous motto, in that they have adapted themselves to present-day conditions. They have adopted a sound progressive industrial gas policy and are, in consequence, improving not only their own business, but the prestige of the British iron and steel industry throughout the world.

The "Best" Price.

Col. W. M. Carr (Stretford): I should like to say how much I appreciate the paper and how much I am in agreement with the excellent remarks just made by Mr. White, who has hit the nail on the head in the matter of gas costs. I am speaking from experience, because in my undertaking at the present moment we have very large increases and a very good balance provided we follow the actual costs of supply in making our contracts rather than taking average costs. In the latter case there is a danger that we may "talk" our costs down too low, and we want to get not the *lowest* price we can for gas for a particular purpose but the *best* price we can get for gas for a particular purpose. In that regard I should like to refer to the author's comparison of oil and gas costs for heat treatment, and I regret that I cannot agree with the summary where he says that under works conditions the cost of heating by town gas is appreciably less than heating by oil, with gas at 1s. per 1,000 c.ft. and oil at 58s. 6d. per ton. I should like to ask Dr. Fells what he means by "appreciably," because I am afraid that our competitors may seize on these figures as being comparative whereas I suggest that they are not comparative. Surely the actual fuel costs in a particular process are by no means the true comparison of saving because we must take into account the reduced scale, reduced spoilage, reduced machining, greater output, and greater flexibility. Surely these are deserving of some consideration in arriving at what is the comparative cost. A very large manufacturing firm in my area is paying a rate equivalent to a flat rate of 23·75d. per 1,000 c.ft. of gas against 78s. for oil, and at these comparative prices all the

oil-fired furnaces are being replaced by gas. The following comparative figures have been obtained:

—	Gas.		Oil.
	Without Purge.	With Purge.	
1	2	3	4
Fuel consumption during working period	38,150 c.ft.	18,164 c.ft.	212 galls.
Work throughput, billets 8–28 lbs.	7,734 lbs.	4,523 lbs.	7,512 ,,
Fuel per 1,000 lbs. of billets	4,950 c.ft.	4,016 c.ft.	28·3 ,,

The effect of the purging flame was, of course, to initiate the diffusion system of flame formation which is dealt with in the paper. The paper is one of the most valuable contributions on this subject of industrial utilization that has ever been offered to the Industry.

The Author's Reply.

Dr. Fells: I notice that the time is officially finished so far as the discussion on this paper is concerned, and I am sure you will agree with me that the questions which have been asked and the points which have been discussed would be much better dealt with in writing than in the very few moments which might be spared me now. Therefore if you will allow me I should much prefer to answer the many important matters that have been raised in writing subsequently. I should, however, like to say how very much I appreciate the helpful criticism of the paper, the object of which was to attempt to assist in this problem of the use of gas in the steel industry. I thank you very much indeed, and especially the speakers who have given me helpful criticism, and particularly where they have not agreed with the few things I have had to say.

Production of Smokeless Fuel in Chamber Ovens at Medium Temperatures

By Eng.-Capt. J. FRASER SHAW, R.N. (Ret.),

Chief Engineer,

AND

Dr. J. G. KING, B.Sc., F.I.C.,

Chief Chemist, Fuel Research Station, Department of Scientific and Industrial Research.

The President: I am sure you will all agree with me that we are very much indebted to the staff of the Fuel Research Board for giving us this paper. They were most willing to give it to us; I had no sooner approached Dr. Sinnatt than I got a reply saying how pleased they would be to co-operate with us in the matter, and we very much appreciate what they have done in putting this information before the members.

Mr. R. E. Gibson (Liverpool): I did not expect to be called upon to open the discussion, especially as I have not had time to digest the paper and have only just run rapidly through it. But what I have seen of it makes it very clear indeed that it will be a very valuable one to the Institution and will add greatly to the sum of knowledge on this important subject. It is another instance of the help afforded by the Fuel Research Board, and I should like to pay my tribute to the work of the Board, because in connection with experiments and researches that we have carried out at Liverpool we have been greatly helped by the published results and information available from the Fuel Research Board.

The paper deals with two methods of carbonization—the brick-built vertical retort, which it shows can be satisfactorily used for low-temperature carbonization, and also the chamber oven which with medium temperatures can also produce a satisfactory domestic fuel. I prefer to look on this very important matter from the practical point of view, and my own preference is for high-temperature carbonization with as little disturbance of the gas making process as possible. The objection to the low-temperature carbonization process is that the thermal yield of gas is very low, and, on the other hand, with regard to chamber ovens, the coke is not so easily ignitable and it is much denser. With regard to this question of bulk density, the paper mentions the advantage of greater density, but I am not so sure that it is really a very great advantage with regard to domestic fuel. In fact, in Liverpool we advertise that a ton of our special fuel is twice the bulk of a similar weight of coal, and I think the customer realizes he is getting a good deal more for his money and is satisfied. [Laughter.] A good deal, of course, depends on how you look at this matter. On the one hand, we have the low-temperature carbonization people whose primary object is to sell the fuel, gas being a secondary consideration. On the other hand, we have the other extreme where we put the gas first and the coke in a secondary position.

It seems to me that some medium course is the one that we should try to follow. In the opinion of many, the low-temperature scheme is not a commercial proposition, but we do know that our own process is satisfactory from that point of view, and the nearer it can be steered to it the better. There are, as we know, some 40 million tons of coal used for domestic purposes, and it will be a very long time before gas is used to replace that large tonnage of coal. In the meantime, therefore, there is a tremendous field for the sale of solid smokeless domestic fuel. My own undertaking has created a market for a high-temperature fuel; the sales are rapidly increasing, and it seems that there is the biggest market throughout the country for a fuel such as the one that we are producing. Capt. Shaw has touched on the question of the amount of gas required for ignition. In our case our fuel is considered to pass the test if it will light with 3½-4 c.ft. of gas. We test it continuously, and we have no complaints. The fuel is used to displace coal to a very large extent, and the people who have once used it want it again and continue to use it. I hope to study the paper more closely, and I am sure it will be very helpful to our Industry. I for one hope that the production of smokeless domestic fuel will receive much greater attention in the future than it has in the past.

Testing Domestic Cokes.

Dr. Margaret Fishenden (Fuel Research Board): I have listened to the paper with interest because I think that if a good combustible coke could be put on the market at a reasonable price it ought to have an enormous sale. As the last speaker pointed out, 40 million tons of coal are used every year in the domestic grate, and if that coal were replaced by gas, even at four times the efficiency, you would have to carbonize another 40 million tons of coal every year because only 25% of the coal is turned into gas as a thermal value, and therefore it seems to me nonsense to talk of immediately replacing all that domestic coal by gas. Of course, it does show what an enormous field there still is for gas in the home, especially when one considers the large quantities of coal used in the domestic grate and the fact that the standard of living is going up with greater demands for hot water and so on.

I am specially interested in the methods of testing domestic cokes. I used to think that easy ignition was the main criterion for a domestic coke, but I am revising my opinion on that point, and am not so sure now that easy ignition *per se* is the most important thing. Perhaps low ash content is even more important. Recently I stayed with a friend who has a cottage in the country where there is no gas, and during my visit I constituted myself firelighter, and I created a record in the quick production of early morning tea by boiling the kettle on an open fire lighted with the residue from an ordinary gas coke fire, and I think that is a simple fact which ought to be more widely advertised—namely, that the residue from a gas coke fire will light perfectly easily in any open grate. One thing that seems to me of importance is that a coke should be combustible for another reason, and that is why I am anxious regarding the method of test. I think that the amount of fuel remaining in the grate after the fire has died out is an important indication of the suitability of a coke for domestic use, because if a coke is of low combustibility it is difficult to keep up a small fire. The fire is all right early in the day, before the ashes have accumulated and while it is burning fiercely, but it is a nuisance if one goes away for

a little while and comes back to find the fire three-quarters full of coke, but out. I have a very simple suggestion to make with regard to that. I expect you all know that the difficulty of the coke fire is to keep a small fire going. There are several reasons why it is easier to keep a big fire going when the fire is piled up high, since the air enters the fuel at the point of least resistance—*i.e.*, most of it goes directly into the flue in an ordinary open grate and never through the fuel. If the fire is piled up high the top of it is in contact with the air going up the flue, but if the fire is low the greater part of the air going up the flue never gets into contact with the coke at all. My suggestion is that people who want an ordinary low open modern grate and still wish to burn coke should put in a grate which is rather too small for the size of the room so that they can keep up a rather deeper fire than would normally be necessary.

I do not think I have any other comments to make except to emphasize my first remark that a very simple examination of the figures of domestic consumption of coal show what an enormous field there still is both for coke and gas.

The PRESIDENT: I am sure we are very much indebted to Dr. Fishenden for her remarks. It is very seldom that she takes part in our discussions unless she says something of a very interesting and practical nature, and she certainly has done that to-day.

A TIMELY PAPER.

Mr. H. J. HODSMAN (Leeds University): I was very pleased to read this paper because it is very timely at the present moment. As previous speakers have said, if the replacement of domestic coal is to take place on a large scale very soon, some people will have to make up their minds as to the kind of process they will employ. I was very pleased to see that the authors give the bulk densities of their products. This is the first paper, so far as I am aware, in which this has been done systematically, because, as I have already shown, there is a close connection between this simple property of coke and its behaviour in use. Dr. Fishenden has just pointed out one very obvious illustration which I have confirmed experimentally—namely, that the ignitability of the cinders of coke is very considerable. The ignitability of a dense coke like an intermittent vertical chamber coke can be considerably increased by reducing the density of partial gasification. Experimental work now in progress at Leeds on that point has shown that very conclusively, but I am not in a position to speak further about that matter at the present time. One of the lessons that I think follows from the paper is the difficulty of making a uniform product throughout.

The authors appeared to have been concerned with the difficulties of what must follow from that—namely, the cost of preparing a fuel which is uniform—but I am not myself convinced that this uniformity is either necessary or ideal. I think the importance of uniformity can be exaggerated, and I pointed out last November that if you can control this uniformity, as, for instance, by imparting a skin of coal to the coke, you can increase the ignitability very considerably. If it must be done there is another alternative recently described by Mr. R. Maxwell, of Consett—namely, to employ possibly a cheaper and more speedy method of carbonization which does not necessarily give a uniform product and then to grade the coke according to its bulk density by a process of pneumatic separation, the bulk density in itself being a rough gauge of ignitability. From such unpromising material as Durham oven coke, Mr. Maxwell has obtained two grades of separated coke varying in density by about 20%, and he claims that one is suitable for open fires and the other one more suitable for purposes for which a denser coke is intended. If that were possible with such rough material, it would be much more promising to attempt to start with the gas cokes made by the intermittent process of carbonization, such as horizontal retorts or chamber ovens. Probably that is an experiment which can only be made on a large scale, but, so far as the Gas Industry is concerned, I am not at all sure that we ought to be afraid of marketing cokes which require to be ignited by special burners. A salesman of a large gas company who is selling grates told me that in his experience, with the majority of customers, the only selling point was the gas required for ignition. If he indulged in technical talk about smokelessness and efficiency, he would receive a vacant, far-away look on the customer's face betraying lack of interest. The fact is that customers do not want to burn coke, but they want a fire which can be lighted without effort. Recently Mr. Boon stated in London that last year over 69,000 coke grates were sold and that most of them "sold themselves."

Previous speakers have referred to the question of testing, but I think that is too big a subject to be gone into at this stage; it would require a meeting to itself.

IGNITION OF RESIDUE.

Dr. R. LESSING: I only wish to say a few words arising out of the remarks made by Dr. Fishenden. She referred to the qualifications that a coke ought to have in order to be suitable for domestic heating. I do not wish to stress the question of low ash now because that has become a truism, and therefore I will not waste words on that aspect of the matter; but the suggestions Dr. Fishenden made about using the residue or cinders from a previous fire for igniting the next one are not only of practical importance but possibly furnish a clue to a good deal of our loose talk about ignitability and combustibility. By the residue I take it that Dr. Fishenden did not mean the complete residue of a previous fire, but the more carbonaceous portion of it after screening out the coke particles that are left and separating those from the pure ash, dust, bats, and so on. These coke particles have gone through a process of partial combustion and therefore have become activated to a certain extent in a similar way to which charcoal is activated for carrying out its various purposes, and this point is one which ought not to be overlooked whenever ignitability and, to a less extent, combustibility, are referred to. In that connection I would like to ask the authors to give us their opinion on the question of the residual content of volatile matter in a coke as far as ignitability is concerned. There is a good deal of uncertainty and, I think, loose talk —I use the term again—in connection with volatile matter which is frequently regarded even now—although I think it ought not to be so any more—as being responsible for ignitability. We have to consider that the volatile matter left in the coke, certainly in high-temperature coke and to a less extent in low-temperature coke, is not of a kind which allows a match to be applied to it and for it to blaze away. A good deal of it is a kind of gas which is of little use in bringing about the lighting up of the coke. On the other hand, the physical structure of the carbon portion of the coke is of the greatest importance, and the example we have had of easy ignitability of the residue which has gone through the fire before seems to confirm that view. Perhaps the authors will favour us with their experience as to the relative importance of volatile matter in low-temperature and high-temperature coke.

Mr. W. H. CADMAN: I think it most appropriate that your President and Council should have arranged for this paper to be given before this meeting of the Institution, primarily because the subject is one which at the present time is very much in the forefront, with regard to fuel problems, and, secondly, because the work which has been so admirably presented to you by the authors is work which has been carried out for a considerable period of time. Indeed, I hardly remember when this work was first inaugurated by the late Sir George Beilby in connection with the Fuel Research Board. It has now reached a stage when it is highly desirable that the Industry should be more familiar with, and make more use of, the results of the experiments carried out not only on the small scale but, for the most part, on the semi-works scale at Greenwich. As I presume you all know, the Fuel Research Station at Greenwich is a Branch of the Fuel Research Board and a Government research institution, the primary object of which is to investigate problems which industry has not either the facilities or opportunities to go into fully for the purpose of being made use of to the fullest possible extent by industry. Therefore, I think it is most appropriate that the Gas Industry should make the closest possible contact with the work which is being carried on by the Fuel Research Board, and I was not surprised when the President informed us that Dr. Sinnatt responded immediately to his request to have this matter brought before the Institution.

A PIONEER.

One of the pioneers in connection with this type of work is here this afternoon. I refer to Mr. Gibson, and it has been a great pleasure to me to be in touch with the efforts that he has been making in Liverpool to put on the market a coke which would be acceptable to the public; he has certainly succeeded in an admirable way. There is a tremendous scope for smokeless fuel. As you know, at the present time a very large number of plants are being erected. Some are actually operating in different parts of the country producing low-temperature coke and most of them are in no way directly connected with the Gas Industry. They have a problem, I imagine, if ever they operate on a large scale, as regards the disposal of the gas of a very high calorific value which is being used mostly, at the present time, for the heating of their retorts. It is rather a remarkable thing to my mind that, although the Gas Industry and the coke oven people have, throughout their existence, used brick refractory materials for their retorts, the low-temperature industry, with the exception of the work which has been described to you this afternoon, have confined themselves to metals, with the difficulties in-

volved such as short life, &c.; and although at the present time heat-resisting metals have made a great advance, at the same time the question of the life of the retort is one of fundamental importance. It seems to me remarkable that with the splendid results achieved at Greenwich, described to you this afternoon, no attempt has been made yet, so far as I am aware, to utilize refractory retorts for low-temperature carbonization.

Now I will pass on to the second part of the paper—viz., the blending of coals to produce a more reactive coke than can be obtained either by coke ovens or gas-works retorts. Last year I was fortunate in visiting the plant at Les Mines de Bruay which is, I think, the only commercial large-scale plant in which this type of work has been done, and in this connection I should like to emphasize the remark made by Capt. Shaw with regard to the domination of domestic coke abroad. But what we understand as domestic coke in this country—for the open fire which we are accustomed to in this country—is very different from the domestic coke which is used in the closed type of grate abroad; and that should always be kept in mind when references are made to domestic fuel abroad, because with the closed-in type of grate you naturally get much more draught. At the same time there undoubtedly are, as you can gather from the paper, great possibilities in the manufacture of a suitable domestic fuel to be started, say, with a gas flame, on an economic scale in the manner described in the paper. The coke is compact and the samples I saw of it abroad certainly indicated that it is a thing which the Gas Industry might certainly look into and develop on a larger scale, following the excellent example set by Mr. Gibson. You have been fortunate in hearing Dr. Fishenden speak of the requirements of a coke for domestic purposes, and I would add to that some information given to me by a lady with whom I was recently discussing this question. She had been trying low-temperature cokes from various sources for cooking purposes and said they all failed to give complete satisfaction because the flame was too short and that until a smokeless fuel could be obtained which would give a reasonably high smokeless flame for cooking purposes, coke would have to be ruled out in the kitchen.

In conclusion, I am quite sure that any of you who at any time find it convenient to pay a visit to the Fuel Research Station at Greenwich to see for yourselves the work which is going on would be, like I myself have been, most heartily welcomed by the Director, Dr. Sinnatt, or the two gentlemen who have presented this paper this afternoon.

Mr. JOHN ROBERTS: I want in the first place to compliment both the authors on this very valuable paper which is a very interesting record of research on a most important aspect of coal treatment. Capt. Shaw has told us that there are two processes described, but I am not quite sure that I agree with him that there are two processes. There are two retorts described, but it seems to me that it is the one process, which really consists of treating blends of coking and non-coking coals at medium temperatures. That is the one process that is described. Of course, it is said that you can treat in the continuous retort straight coking coals, but I rather fancy that that would not be the system which the authors would recommend, inasmuch as they would get far better results if that strongly coking coal were first pre-treated.

CONTINENTAL PRACTICE.

Regarding the types of fuel—the closed stove type and the open-grate fuel—it is quite true that the Continental market differs from the British market in that respect, but if a satisfactory closed stove fuel can be made in ordinary coke ovens at medium temperatures, it is perfectly obvious that you can make an open-grate coke in the same ovens from the same coals at the same temperatures. It is just a question of the condition of the coals when they enter the retort. The process employed at Bruay has been mentioned, but there, of course, they set out to make a closed stove fuel and it is an excellent fuel. At the same time they are making in those retorts a fuel which appears to be practically identical with this fuel of the authors which presumably is made in the intermittent retort.

Capt. FRASER SHAW: They are all intermittent.

Mr. ROBERTS: I have somewhere in my office a coke that is identical with the sample exhibited here to-day and if this is an open-grate fuel then the other is.

The question of grading and texture is simple, and no gas engineer is worth his salt if he said he could not produce open-grate coke from the coals they use in France, if he were wanted to. Mr. Cadman has said that it should be to the interest of the Gas Industry to look into the process which has been adopted at Bruay, but I am afraid I do not agree. Neither that process nor the processes advocated in this paper are of very much interest to the Gas Industry in that they give you a very small output of gas, and you are essentially gas manufacturers. Solid fuel is a side-line with you, and, besides, it is not your business. It has often been said that the home of the low-temperature industry, when it comes, should be the Gas Industry and the gas-works, but here I do not agree. There are other people who are supplying the domestic consumer with solid fuel and there appears to me to be no reason why that solid fuel market should not still be reserved to people outside the Gas Industry. For that reason I would say that I should not welcome the Gas Industry entering that field at all.

There is a point mentioned in the paper that I should like to straighten out. Reference is made to the experiments which were carried out at Ramsgate some years ago, and it is said that they were done from carbonization with plants made according to my patents. That is not quite correct. The work done at Ramsgate was done in accordance with Patent Specification No. 228,686. That was the high-temperature process, and that is the process which interests you, not the one described in Patent No. 187,366, which is a medium-temperature process, and I cannot distinguish between that and the one described in this paper and carried out by the Woodall-Duckham people. The process which really interests the Gas Industry is one which gives a good yield of gas at the same time—*i.e.*, using your high temperatures in your flues, using blends, and adopting short-coking periods.

THE AUTHORS' REPLY.

Dr. KING: We will reply to the discussion in full later and also at the same time deal with the further discussion which we hope to receive in writing. There are one or two points, however, which are worth drawing attention to now. Mr. Gibson said it is obvious that the Gas Industry will play a greater part in the production of smokeless fuel in the future. Mr. Roberts has just said that the main function of the Gas Industry is to produce gas, and he does not think the production of smokeless fuel is so important. It is interesting to hear these two diverse opinions and to bear them in mind. In Capt. Shaw's introduction he drew attention to the possibility of smokeless fuel and the desirability of having smokeless fuels which are easily ignited and which will burn freely in the open grate. Dr. Fishenden drew attention again to the test which we used, and we have said we would like to amplify on this. At the same time, Dr. Fishenden might have told you that it was her own test which she has designed and which we are carrying on to the best of our ability. The ease of ignition of cokes seems to me to be a very important factor. You may have a good fire when it is first lighted, but when it burns down you must be able to make it burn freely. If the coke will not ignite readily it will not burn so readily after it has gone down. Therefore ease of ignition, not only at the initial stage but after subsequent burning of the fire, is rather vital. We appreciate very much Mr. Gibson's remarks about the helpful assistance he has had from the Fuel Research Board in his own work at Liverpool and thank him for his expression of appreciation. Mr. Hodsman, whom we also recognize as an expert in the examination of smokeless fuels, has given us some interesting comments about smokeless fuel. One point he has made is that it is possible to produce in the coke oven a smokeless fuel by carrying out carbonization in the usual way and separating the products into dense and lighter fuels. I think this statement, however, is not quite so important as it sounds, since we have had the privilege of examining cokes produced in this way and have found that the percentage of light fuel, which is said to be more combustible, is very small in comparison with the output of the oven, and, moreover, it is not nearly so combustible as one might imagine.

The importance of volatile matter was referred to by Dr. Lessing. That is rather a wide subject, and I would prefer to reply to that in writing. It is nevertheless essential that the amount of volatile matter remaining in smokeless fuel should reach a certain percentage and that it should be distributed uniformly throughout the coke. That gives one of the reasons why we have endeavoured to make this coke uniform throughout, and if any of you care to examine the specimens which we have here you will see that some of them are very uniform throughout. The one that is not uniform is one which we have not so much overheated as heated the coke for too long a period. The grey appearance of the outside is quite marked.

It was very kind of Mr. Cadman to talk to us about the important work which he is doing, and he invited you, in our name, to visit the Fuel Research Station. Both Capt. Shaw and myself hope you will take advantage of that invitation. Mr. Roberts has given us the benefit of some of his experiences and has mentioned our reference to the work carried out in conjunction with his patents. He can be described as the pioneer in this country of this type of work and undoubtedly his process, if carried out in this way, gives results which are equally as good as those pro-

duced at Bruay, and Mr. Roberts' work was carried out at a very much earlier date than the work at Bruay. Mr. Roberts says we have only really described one process, but we do not altogether agree with that, because there is one distinct difference between the two processes which we describe. One is a process of continuous carbonization and the other is a process of static carbonization, and we consider that to be a very important difference. I should have liked the members of the Institution to have said something more about the means which we are using for the production of this smokeless fuel and to have offered us their very valuable experience and hints as to how we should go on in the future if we are to improve upon the stage which we have now reached. Capt. Shaw, in introducing the paper, emphasized the fact that this is a research which is going on and is not one that has been completed. Therefore we should indeed welcome any advice from those who can give advice, if you will be good enough to send it in in writing, as to how we ought to go on to improve upon our present position.

I thank you, Mr. President, and gentlemen of the Institution for the very kind way in which you have received the paper and the very kind things which the various speakers have said to us.

Impressions of the Gas Industry in Canada and the United States of America

1—Gas Production

By Col. W. MONCRIEFF CARR, O.B.E., T.D.,

Engineer, General Manager and Clerk, Stretford and District Gas Board.

Mr. F. C. BRIGGS (Dudley): I am very pleased to accept this invitation to take part in the discussion on this paper and to say how fascinating the paper is. I am sure to those members who were not privileged to go to America with the delegation, if the papers suffer at all they suffer from the fault of being far too brief. Certainly in the case of Col. Carr's paper I should have liked a good deal more information than it gives. Col. Carr himself has pointed out in the summary at the beginning the important points of interest to him, but there are one or two others which rather appeal to me. One is that in the land of the birth of carburetted water gas apparently carbonization is coming into its own in place of carburetted water gas, to a great extent due to the reasons pointed out in the paper. It is also interesting, and perhaps a certain amount of comfort to us, to hear in this country that sulphate of ammonia is equally unremunerative in America as it is here. Another point which Col. Carr mentions as of great interest is that there is a smaller percentage of the population in America taking gas compared with the position in this country, and one rather wonders whether that is partly the reason why the consumption per consumer is so very much higher. Does the American Gas Industry, in fact, take the cream of the business and leave the common or garden working class population more or less without gas? One rather wonders that because in Mr. Masterman's paper it is mentioned that there are very few slot meters in America and Canada.

One cannot discuss a paper of this kind but can only sit at the feet of the mighty and learn. Therefore, I would like to ask a few more questions. Col. Carr makes a great point of the mixing of natural gas with manufactured gas and one gathers that for financial reasons the natural gas is taken constantly in order to get a constant load factor and that the balance is made up of manufactured gas which is varied either in quantity or quality. What effect has this on the consumers' appliances? Does it mean a varying specific gravity and does that give rise to difficulties in such plants as the St. Louis mixing plant? The paper mentions that the calorific value of manufactured gas has to be altered slightly to overcome the varying qualities of the natural gas; but one would rather think that the conditions would not be so constant as we endeavour to make them in this country. Again, what is the actual pressure at which the gas is really used, say, at the consumers' services? One notices again that in St. Louis the gas is actually distributed into the distributing system at very high pressure, I think 20 lbs. per sq. in. To what pressure is the gas reduced at the consumers' services? Is it reduced there or elsewhere, and, if it is reduced at governors, are they district governors or consumers' governors and do troubles arise from gumming?

The use of refrigeration is mentioned to obviate gumming, but there is only a casual mention of this in the paper, and one would like to know if there is any great difficulty in that respect, because that is one of the difficulties which personally makes me hesitate to use service governors to too great an extent, although one feels that in this country we shall be eventually forced, due to peak load difficulties, to run at very much higher pressures and to have service governors.

Another very interesting point mentioned is the mixing of coke breeze with coal for carbonization, and I should like to know in what way the difficulty of the breeze separating out from the coal is overcome. Is it simply mixed with the crushed coal and does it separate out or is it briquetted in any way? The point is not quite clear in the paper; nor is it clear whether this mixing was in connection with coke ovens or vertical retorts. Coke ovens, of course, are an easier proposition in this respect, but it seems to me that with vertical retorts if the coal is crushed with the breeze and briquetted, there will be some difficulty. Mention is made of the use of waste-heat boilers in the hot producer gas pipe line. I may be a little dense, but I do not quite see the great advantage of waste-heat boilers on producer gas. It seems to be taking the heat out not very usefully, unless, of course, the producer gas plant is a considerable distance from the actual oven. The making of oil gas in vertical retorts is a process which has not been developed in this country because of the many difficulties in connection with the process. Finally, mention is made in the paper of the production of oil gas in some of the retorts to enrich the coal gas, and I should like to hear from Col. Carr whether that process has really been successful and whether there is any reduction in output from the plant. I think we should congratulate Col. Carr on a very excellent paper; the time and energy expended on the preparation of which must have been considerable.

AMERICAN HOSPITALITY.

Mr. J. H. CANNING (Newport, Mon.): I should like in the first place to congratulate Col. Carr upon the excellent paper which he has produced and to congratulate our President upon the happy idea of collecting together for the benefit of the Institution, in the three valuable papers which are to be presented to-day, the results of what the delegation saw in America and Canada last autumn. I should also like to emphasize what Col. Carr says at the commencement of his paper and to pay a tribute to the wonderful hospitality which our American friends extend to everybody who visits them. I cannot imagine anything more wonderful than that hospitality, and I do not think we can ever express our gratitude sufficiently for it. My visit to America was more in the nature of a courtesy visit than a visit for technical purposes, but, nevertheless, every facility was given me at every place I visited to inspect the works and to see everything connected with gas manufacture and distribution. The paper refers to the magnitude and importance of the Industry in Canada and the United States, having regard to the abundance of cheap electricity, and I must say that that was one of the first things which impressed me there. One may say, generally speaking, that both gas and electricity are flourishing side by side in spite of the fact that there is very keen competition between them.

I do not think I can add anything very considerable to what Col. Carr has said, but there are one or two points to which I should like to refer. Natural gas does not interest us very much in this country in spite of the fact that the Government passed a measure recently with a view to controlling any natural gas that may be found, but as is pointed out in the paper it plays a very important part in the Gas Industry of America. I note what is said in the paper with regard to the capital employed in natural gas

and from the figures given for Ontario I have worked out from the total consumption of 6,300 million c.ft. that the capital employed seems to run out at a little over £850 per million. I was wondering whether that capital simply related to what one may call the well head costs. In other words, does it simply cover the cost of sinking the well and fitting the various appliances necessary for controlling and regulating the supply of gas, or does it also cover the cost of the distribution system? One also feels a little curious as to the financial effect of the depletion of the gas fields. Col. Carr refers to the fact that the gas fields in Ontario are becoming depleted, and in view of that fact I presume it will be necessary to put up carbonizing plant in place of the gas wells, and one wonders a little how the capital problem is managed. Is any provision made for writing off the capital expended on the gas wells by the time they become depleted and for providing the necessary capital for the substituted carbonization plant at the end of the life of the wells?

Reference is made to that wonderful pipe line 24 in. diameter and 980 miles long carrying natural gas from Panhandle, Texas, to Chicago. That pipe line was put into operation during the period of my visit to America, and I heard a great deal about it. I rather wondered at the time whether it really could be a profitable proposition to bring gas such a distance in view of the fact, also, that I believe the pressure has to be relayed several times *en route*. The initial pressure is not sufficient to carry the gas from Texas to Chicago. I do not know also whether Col. Carr can tell us anything about the change of calorific value. The calorific value of the Chicago gas prior to bringing in the natural gas was 530 B.Th.U. per c.ft., but it is now 800 B.Th.U., and it seems to me that they may have experienced some difficulty with regard to the adjustment of apparatus with a change of such magnitude.

I had the pleasure of going over the coke oven plant and the producer plant at Montreal, which has been so well described by Col. Carr, and I can only confirm all that he has said about it. Mr. Briggs has raised a point which naturally occurs to one as to why waste-heat boilers are installed on producer gas, but I think I am right in saying from memory that the producer plant is situated at a fair distance from the coke ovens.

Reference is made in the paper also to the gas produced by the manufactured Gas Industry in the United States, and it shows that there has been a reduction of about 11·8% in 1932 as compared with 1931. The point is made in the paper that the Gas Industry in America has suffered less from depression than most of the other industries, but when I was there in 1931 I was told that the iron and steel industry showed a decrease of from 30 to 40% and the coal industry even more. Some of the Canadian works are bringing coal from Pennsylvania, a distance of 400 miles, I believe, and that must constitute a considerable handicap against them, though while I was in Montreal I found they were getting a very good price for coke. If I remember the figures rightly they were paying about 5½ dollars per ton for coal and they were getting 8¾ dollars per ton for coke. Another thing that struck me at Montreal was the provision that had to be made for the winter. As you know, the Canadian climate is very severe and the St. Lawrence river is frozen over each winter. I was there in October shortly before the winter began, and I was told that they had a coal storage of 300,000 tons which amounts roughly, I should say, to at least 200 days' maximum production. Then coke had to be stored for the central heating load during the winter and at the time of my visit they had a stock of less than 170,000 tons.

Waste-Heat Boilers.

Mr. J. H. Clegg (Burnley): Several congratulatory remarks have been offered to Col. Carr for his paper and I will not waste time repeating them except to say that I entirely concur with them. This paper is one which can scarcely be discussed. It is more a matter of asking questions for the elucidation of certain remarks which have been made, and I will take them in the order in which they appear in the paper. The first point that struck me has already been mentioned—*i.e.*, the insertion of waste-heat boilers in the hot producer gas pipe lines. I do not know quite what Col. Carr means to infer there, whether some of the producer gas is combusted in order to produce steam or whether he means to infer that the sensible heat of the producer gases is used for the production of steam. I think that will be rather difficult, and in any case I do not quite understand what thermal efficiency is expected to result from it.

It is suggested in the paper that it has been to the good of the American Gas Industry that the various associations should be consolidated. This is directly contrary to the remarks made by the President in his Address, and it would be rather interesting at some later date to have a fuller discussion on that particular question as to the various advantages and disadvantages of the co-ordination of the various associations and institutions.

America being a country which is associated with the production of crude petroleum it strikes us rather strongly that there should be produced there such a large quantity of manufactured coal gas. They are fortunate in being able to obtain natural gas, but one question which arises in my mind is how long such a supply will be available. Later on in the paper it is remarked that one well had been in existence since 1889—it sounds rather incredible—and perhaps Col. Carr has obtained some information as to how long these wells are likely to last. The reference to capital costs of the production of natural gas show that the cost per million c.ft. produced is much higher than in this country, but taking comparative values into account the capital cost may, of course, be considerably less than in the manufacture of coal gas. Perhaps Col. Carr will save our time in looking up the figures in that respect and give us some idea of the comparative capital cost in regard to natural gas and manufactured coal gas.

It is also mentioned in the paper that bottled gas is used rather extensively for supply in rural areas, and I am rather surprised to find that there is no mention of the use of high-pressure gas for internal combustion engines for transport bearing in mind the high calorific value of the gas and the advantages of the high pressure at the commencement. One would naturally have thought that they would have developed in this direction. The figures given in Table I. of the production and purchase of gas from 1929 to 1932 are interesting, but I gather from these figures that there has been an alarming reduction in the production and sale of gas. If I have gained the wrong impression on that point no doubt Col. Carr will correct me, but if the reduction in output is as much as I imagine, I think we require more explanation than the fact that the world depression has caused it.

The use of calcium chloride has been in vogue there for some time for the treatment of coke and the prevention of dust. I have not seen any applied, and perhaps Col. Carr will give us the information as to whether the treatment has been effective for the purpose for which it was introduced, and what is the appearance of the coke. As Col. Carr went to Rochester perhaps he can give us some impression how the Sulzer plant is going on there. In the paper which he read two or three years ago Col. Carr gave an account of that plant, and it would be interesting to hear how it is functioning at the present time.

Automatic Control.

The automatic control for the mixing of gases of widely varying heat value is not surprising, and it is more in evidence in America than in England because there are much larger units there than here. But the automatic temperature control devices in America were particularly interesting. We have an American automatic temperature recorder and indicator at Burnley which is functioning very reliably and satisfactorily. I notice that waste-heat boilers are largely used in the water gas plant, and it would be interesting to know if any of these are fitted with the back-run process.

With regard to the use of coke oven coke for the manufacture of water gas, we have been compelled to use this on odd occasions during coal strikes, and I found great difficulty in using our plants due to the hot generator top. There is no mention in the paper of the type of carburettor which we have in Burnley and which I believe is the only one of its type in this country—*i.e.*, the checkerless carburettor. I understand that the checkerless carburettor for the use of oil at high pressure is very much in vogue in America. Speaking of the carburettor, does Col. Carr mean that the heavy oil fractions are fractions from petroleum oil? I should imagine he does, but I should like to make sure on that point. I am also interested in the fact that exhaust steam is used for the manufacture of water gas. The engines and turbo-exhausters are working against a back pressure of 10 lbs. per sq. in., but I should like to know the exact pressure of the steam available at the water gas plants.

Lastly, one of the most important points to my mind, in order that we may assess the value of the processes in America from the economic point of view in comparison with English practice, is the relative prices of oil, coal, and coke in that country, and it would be interesting if Col. Carr could give these. I think we are very much indebted to the author and the other authors for their papers and for placing on record such valuable contributions for the advantage of those who were not able to visit America.

A Leading Utility.

Alderman F. J. West: I should like to join with other speakers in congratulating Col. Carr on his very comprehensive survey of the several aspects of the tremendously wide field of technical and engineering facilities which were

presented to the members of the delegation of the Institution of Gas Engineers in the United States and Canada last autumn. Col. Carr stresses the point—it is also referred to in the two subsequent papers—of the vigour, the alertness, and the progressive spirit of the Gas Industry in the countries we visited, and I would venture to extract just one sentence from Mr. Masterman's paper in which in a particularly significant sentence he sums the Industry up when he says, "The Gas Industry fulfils its *rôle* as a leading utility in a community renowned for bold commercial adventure." Col. Carr emphasizes the magnitude and importance of the Industry and it is particularly gratifying in a country where, as he states, electricity is cheap and abundant and is extensively and, indeed, extravagantly used. The paper also emphasizes the fact, which is a great surprise to many people in this country, that the average consumer approximates to 30% more consumption than the average consumer in this country. Col. Carr also draws certain conclusions from the progress they have made in technical development of waste-heat recovery and the use of oil in carbonizing processes. We ourselves have been travelling along these lines in this country. Another point emphasized is the use of scientific control instruments in the various processes of the Industry in the United States. Rule-of-thumb methods and dependence on the human factor, which I suppose were very prevalent in this country and indeed in the United States 30 or 40 years ago, do not exist to-day, and I believe we would do well to follow their lead in this direction.

I would conclude, as the time is short, by emphasizing the great advantage of organized visits and the interchange of opinion as reflected in the three papers presented to us this morning. It may have appeared a very bold adventure to leave England for five weeks on a comprehensive tour like this, but I think every member of that delegation will wish me to say that it was well worth while. Apart from the definite expressions of opinion in these papers and the conclusions drawn, there was the tremendous advantage of personal contact and interchange of opinion with our friends Overseas which I think are in the best interests of the Gas Industries of Canada, the United States, and Great Britain, and I hope that this tour is the forerunner of further interchange of visits at not too long intervals between the three countries.

Cleaning the Producer Gas.

Mr. F. B. Richards (Woodall-Duckham Companies): As time is short I think I can most usefully confine myself to providing answers to one or two of the questions that have been put to Col. Carr, and at the same time I would like to associate myself with the congratulatory remarks which have already been made by previous speakers on this excellent summary of the impressions gathered during a most interesting tour. The question has been asked: Why are waste-heat boilers applied to the stream of producer gas used for heating the coke oven? The answer to that question is, I think, that coke ovens have been developed essentially for heating by means of clean pure gas, unlike our carbonization plants in this country, and in consequence of this it is necessary thoroughly to clean the producer gas before it is passed into the coke oven, which is a highly complex structure. Before this gas can be cleaned by water scrubbing it has to be cooled and one cannot afford the thermal loss of a very large amount of sensible heat content in the producer gas. Hence, the waste-heat boiler provides the steam necessary for the producers and for all the ancillary plant attached to the producer house.

With regard to mixing breeze and coal, those of you who are in touch with the coking industry in this country will be aware that the mixing of breeze and coal is very extensively practised now in Great Britain for two reasons; first, as a means of absorbing and converting to a higher value what is normally practically a waste product; and secondly, without our high volatile coking coals the structure of the coke tends to be very weak, and the mixing of a certain amount of finely powdered breeze with this coal very much improves the structure of the coke, and it is partly for that reason that mixing is practised in America also. The mixing presents no difficulty if thoroughly carried out, and segregation is prevented by pulverizing the coal so that you have a material which on handling into and out of the bunkers does not tend very much to segregate once you have mixed it.

Another point I should like to touch briefly upon is the question raised by one of the previous speakers as to why the percentage of the population served by gas is smaller in America than it is in this country. I think the answer is very much that the agricultural and rural population in America is much larger relatively than it is over here, and therefore a very large proportoin of the population is out of reach of gas supply.

Electrical precipitation has also been mentioned by Col. Carr, and it is a matter which I would commend to the serious study of gas engineers in this country. It is difficult to show on paper that electrical precipitation will pay, but in point of fact it is now standard practice in coking plants in Great Britain. All new coking plants are so provided, and I think it will be out of the question to put the clock back, if one suggested it, in the coking field. I believe that at any rate the larger gas-works will find it well worth while to follow suit. Several works have already done so and I believe are very well satisfied with the result.

Finally, I feel that the outstanding impression one has gained from this American trip is the effect of environment upon the trend of development. You have there a severe climate and a need for central heating, and that leads to a large thermal consumption *per capita*, where supplies of gas and coke are available. These are two of the best media for house heating. The hard coke market for central heating has led to the use of the coke oven as a means of manufacturing gas, and I think it is very interesting to see how the conditions have led to quite a different line of development from that which we have followed in this country.

Col. Carr expressed his gratification at the very kind way in which they had received the communication, and he said he would reply in writing to the questions raised in the discussion and also to any other questions which members might have and which they have not had an opportunity of putting forward.

2—Distribution and Utilization

By C. A. MASTERMAN, M.A., F.I.C.,

Chief Technical Officer, The Gas Light and Coke Company.

Dr. C. M. Walter (Birmingham): I have been very interested to read Mr. Masterman's paper and to hear of the various schemes which are in vogue in the United States, and particularly in connection with the testing of gas appliances and the furtherance of the use of gas particularly for industrial purposes. As I hope to visit the United States and Canada during this autumn I have been more than usually interested in all the papers which we have had, and particularly in Mr. Masterman's paper in view of the fact that he has dealt with industrial heating, among other subjects.

In the first place, he mentions competition, and says that competition in America does not seem to be any greater than it is in Great Britain. It seems to me that this is probably due to the co-ordination of policy that exists between electrical and gas undertakings and the fact that in many instances the gas and electrical undertakings are controlled by the same company. Then, of course, with regard to natural gas, we have had the extraordinarily low figure of 1½d. per therm, which is rather less, of course, than the cost of producer gas with normal plants in this country. I should like to ask Mr. Masterman whether he found that with these very low prices steam raising on a commercial scale was carried out with natural gas at any of the factories that were visited. It seems to me that when one gets down to such prices it does bring in the possibility of large-scale steam raising plant.

Another matter referred to by Mr. Masterman was the question of personnel, and particularly the use of the telephone for contact with the consumer. Although this may appear a small point, I really feel that we have a lot to learn from the American system of dealing with consumers' complaints. In Birmingham we have for many years always arranged so that our service engineers worked in districts, and in the event of any consumer requiring any information or having any complaint in the particular district, he is always put in contact with the actual service engineer who is dealing with the matter. I believe this is a common practice in America, and I also believe that it all tends to increase the efficiency of the service.

With regard to the method of certification of appliances

by the American Gas Association, I think we in this country have a lot to learn. I feel that the time is coming when in this country we shall have to approve both domestic and industrial appliances much in the same way as the American Gas Association does, and I am rather surprised that that scheme has not developed to a greater extent in this country than it has up to the present time. I do feel that in view of the large amount of work that has been done by some of the larger undertakings, the time is ripe when some form of certification of appliances should be adopted.

Individual Undertakings and Research.

The author perhaps gives the pith of what he found in regard to industrial appliances in Section VI. of the paper, and a very interesting point which he makes is the fact that although we know of the large amount of research work which has been done in America, strangely enough the individual undertakings do not appear to have developed the use of industrial research laboratories and industrial showrooms to the extent that is being done in this country. I presume this is due to the liaison between undertakings and the American Gas Association, which is doing such important work in this respect. Mention is also made of the fact that concentration is directed rather towards adjustment of prices than to design of appliances. I was interested to hear of this because I have always been led to understand that so far as efficiency is concerned we in this country have been able to show considerable improvement over some of the American designs of industrial plant. Further, I should like to ask Mr. Masterman whether the use of the air blast furnace is still more or less a standard method of employing gas for a large number of industrial appliances. In this country we are rather developing towards the use of atmospheric designs with the recuperator system.

In connection with cookers, I was very glad to read the remarks with regard to the stamped steel cooker, and I should like to ask whether it is not possible for cookers of that type, made of stamped steel, with very considerably lower thermal capacity, to be designed in such a manner as to give even higher efficiencies than are at present possible with the heavier type of apparatus now being used in this country.

Work of Outside Contractors.

Mr. S. B. Chandler (Tottenham): Mr. Masterman is deserving of great credit for the clear and lucid manner in which he has dealt with the subject of distribution and utilization practice in America and Canada, particularly in view of the short duration of his stay. The examples he gives, which in many instances very nearly relate to English practice, are most useful and informative. Arising from his remarks there are many features which deserve special emphasis, particularly as we in this country are finding it more necessary than ever to concentrate upon distribution and sales organizations. Under "Organization" it is noted that much of the work of installing appliances is done by outside contractors; this practice, which does not appear to be common in England, has advantages and is to be commended, as, by the employment of approved outside contracting firms, an undertaking can establish a permanent staff of skilled company-trained fitters and retain this staff irrespective of the amount of work the department is called upon to perform. The necessity for the engagement of temporary employees to cope with a rush of work is avoided; this, I suggest, is a very desirable factor, particularly when special supervision and examination of contractors' work is given, this being necessary in order that correct and proper installation of apparatus may be assured.

With regard to commissions on sales, there can be no doubt as to the beneficial effect where a bonus or commission scheme is in force. Theoretically, an employee's efforts should be uninfluenced by additional payment upon results, but in practice this is not always the case, and, provided a living wage is paid, the idea has many advantages. Of recent years one of the outstanding features of the sale of all classes of goods to the public is the application of the hire-purchase system, which has been adopted by the Gas Industry for some years now with very great benefit. The ability to secure articles by payment over extended periods possesses many advantages to the consumer. In the case of the Gas Industry the purchase of appliances under these terms not only ensures retention of the apparatus over a long period—the consumer regarding it as of particular value—but a much wider choice of appliance is available, and during the term of hire-purchase the gas undertaking has a more than academic interest in the appliance and its maintenance. Apparatus on rental can be very easily displaced in favour of other forms of energy consuming plant.

The use of the telephone appears to be much more extensive than in this country. Does the author think that the telephone, which, as he shows, plays so large part in American business and domestic life, is rather over-done and that in many cases the personal call, rather than the telephonic conversation, would be of greater benefit?

With regard to refrigeration, undoubtedly climatic conditions have a great deal to do with popularity of this form of appliance. There is now, however, a tendency in this country to pay more attention to the preservation of foodstuffs in the domestic sphere; recent sales in the British Gas Industry have been very encouraging, and I foresee considerable extension. Gas-operated refrigerators represent a very welcome day and night load—a small but steady consumption. Showrooms are put to very good use indeed, and the home service section to which the author refers is an excellent method of encouraging the interest of the woman consumer, who, after all, has the first and last word where domestic apparatus is concerned; this is an idea which can well be tried out by English undertakings. Service of this kind will undoubtedly have very definite results as experience has proved with those undertakings who have put into operation special Women's Advisory Sections, who maintain contact with the women on the district. The institution of a rest and recreation room in each showroom and the broadcasting of information that can be used without charge, somewhat on the lines of "Meet your friend at the Gas Showroom," must be of benefit and represents a most useful and welcome service.

Self-Ignition of Burners.

The self-ignition of hotplate burners on cookers strikes a new note; at the British Industries Fair this year a system of this kind was on exhibition, but so far as I have been able to ascertain, it is not yet in production. One is perhaps a little surprised to learn that coin meters are not popular. This is quite contrary to British practice, and it would be interesting to learn the reason for this. Is the "payment before use" system in use, and what factors influence the position?

As to electrical competition, particularly in relation to cooking and heating, the ability of the Gas Industry to meet this is greatly assisted by the very excellent types of cookers, fires, water heaters, and numerous other appliances made available by manufacturers who not only produce very good designs but have set up expensive laboratories and testing methods in order to ensure efficiency in use and attractive appearance. At the same time, the electrical trade is very much to the fore in producing extraordinarily neat and efficient appliances of good design, particularly small types such as domestic irons, toasters, kettles, &c. Previously prices were rather prohibitive and adoption by the public rather restricted, but recently prices have shown considerable reduction, and sales have increased largely owing to this factor—particularly in electric cooking and heating appliances can this be noticed.

On the other hand, makers of gas apparatus do not seem to have kept pace with price reductions, and while the Gas Industry realizes the expense of research, testing, and other factors which contribute so largely to efficiency, the attention of manufacturers should be drawn to the still further help they can be to the Gas Industry, and incidentally to themselves, by attention to this point. The price factor plays an important part in influencing the adoption of gas for cooking and heating and domestic use, and anything that can be done to make proposals more attractive must assist in maintaining the popularity of gas for these particular purposes.

The President: I could reply to one or two of the questions that have been raised quite easily, although I did not see a great deal of the details when I was in America. I was too much concerned with getting from one town to another and being received. [Laughter.] It was very obvious, however, the reason why slot meters are not popular there. It is because robberies have been enormous. I do not doubt for one moment that they started slot meters in the same optimistic spirit that we did in 1898, but the robberies were terrific, and sometimes they were very ingenious, because, owing to the climate in the winter, it was quite easy to make frozen pennies, and afterwards there was no trace of the thief. [Laughter.]

Mr. Masterman Replies.

Mr. Masterman, replying to the discussion, said: Dr. Walter has raised the question of the possibility of using low priced gas for steam raising. I quoted a contract in the paper, which, as it happens, was signed while we were in the offices of the Company in Chicago. That contract was signed with one of the big packing firms for a supply to their stock yards for 15 million c.ft. per day at 3 cents, or 1½d., per therm, which is the price I mentioned in the paper, and that supply is primarily for steam raising. Where you have gas at such a price it is obviously a practical proposition. As to the testing of appliances, Dr. Walter referred to the work done by the American Gas

Association, which is very thorough and very systematic, and he suggested that we might very well copy it in this country.

There was, however, one point which rather surprised me, and that was that, though this work is very thorough and systematic, it seemed to me to go very little beyond the carrying out of the rigid test. A certain small amount of help might be given to the apparatus makers, but there was very little prolonged co-operated development between the American Gas Association laboratory staff and the appliance makers. It might well be that one's whole impressions of America in certain respects may be unreliable, but that is certainly the impression left on my mind, and I think we lead the way in co-operation in development work and research. The development that takes place out there seems to me to come chiefly from the laboratories of the undertakings rather than the laboratory of the American Gas Association, which is purely a testing centre. Dr. Walter also referred to the absence in America of industrial laboratories, and asked questions about the development of industrial apparatus in America. That was a point which made a great impression on me—namely, that a number of technically competent people were looking after the installation side and that that work was done very thoroughly indeed, but the design of the apparatus, so far as it embodied technical considerations, seemed to be no advance on design in this country. Where the Americans are in advance is in the completeness of their installations and the testing of their installations. Whether we can follow the American lead in regard to stamped steel cookers, it will be interesting to see; but I do not think it follows that the stamped steel cookers are the only kind of tolerable cooker or that there are necessarily any technical advantages connected with them. The advantage, if any, of the stamped steel cooker is that it may be possible to produce it at a slightly lower cost, but the first necessity is a very large production to cover the very high cost of tools. As a matter of fact, going round the works of gas appliance makers in America I found there were so many makers of appliances that no one series of cookers had a sufficiently wide sale properly to cover their overheads on the tools, and consequently we found that cookers over there were very considerably in advance in price as compared with cookers in this country.

Reference was made by Mr. Chandler to the installation work being carried out by contractors, and the aspect of that which appealed to me, and to most of us, was that by using the contractor you make a friend of him, and the Gas Industry profits by that friendship, which is a very real thing. It was not, however, universal practice to use the contractor. Neither was it universal practice, for instance, to take a commission on sales, and I think I am right in saying that at Montreal they have ceased to pay commission to their salesmen, although they had been doing it previously. Therefore, although these generalizations have been made in the paper, some of them may be incorrect as affecting individual cases.

Use of the Telephone.

As to whether the telephone in America is over-done, I often feel it is over-done in Great Britain. I referred to it because they have got this system there which we have not got over here, and the consumer ringing up a local gas office to explain some trouble does not get switched on to somebody else and have to start explaining all over again. There is a specialized operator on the line, and if he wants assistance he immediately brings to the telephone the inspector or man who really knows the consumer, and there is no break in the conversation. It is like the inspector and the man coming to your door, and they all three carry on the conversation on the same lines. That, I think, is worth doing, and the only plea that I have with regard to the Home Service Section is that we shall gradually develop in this country on the same lines. Until one has been over in the States one has no conception of the help which a properly and fully developed Home Service Section can be. There was no time or space in the paper to give the full details, but they have a selected body of specially skilled women who are making friends the whole time, and people look on the gas undertaking's showroom definitely as a social friendly centre where they can go and meet their friends, and at the same time get assistance in connection with household problems and problems going far beyond the mere use of gas, such as the question of etiquette in arranging a dance or bridge party, and things like that. They have a whole host of specialized women there of which we have no counterpart in this country, where we think that a demonstration of cooking is the beginning and the end of all we can do.

3—Administration, Accounting, and Publicity

By THOMAS CARMICHAEL, M.Inst.C.E., M.I.Mech.E.,

Engineer and General Manager, Portsmouth Gas Company.

Mr. H. D. Madden (Cardiff): I think it was a very happy inspiration that promoted the idea of presenting these three valuable papers to the Institution. I regret personally that I was unable to accompany the delegation to America, but I have spent some little time in reading the papers, and as Mr. Carmichael kindly asked me to speak on his paper I have great pleasure in doing so. Really, however, one cannot discuss these papers. One feels, if I may say so, a certain amount of humility in regard to knowledge of the practice that obtains in Canada and the United States, and it is all to the good that we have sent out some of our ablest members to bring us back a report of the position. One lesson that has struck me in Mr. Carmichael's paper above all others is the question of salesmanship in the United States, because I do think, notwithstanding the efforts of the B.C.G.A., that the organization in America is an example to us. I think that is summed up in one paragraph where Mr. Carmichael puts his finger on the weakness of the Industry in this country when he refers to " the reluctance in this country on the part of most undertakings to employ a sufficient number of more highly paid demonstrators and technically trained salesmen." That, I think, is the greatest lesson that we can take from this paper. In looking up and down the country one sees the carelessness with which the sales side is developed, or rather not developed, and is allowed to drift; and there, I think, is a point to which we must pay great attention if we are going to give our consumers satisfaction. One matter that has been brought to my mind is the reference to the cooker demonstration and the services which the Canadian and American Gas Companies offer. Take our own case. In this country our cooking load is not what it should be because the country is drifting too much to the use of canned foods. People open these canned foods and do not take the trouble to cook, and it is in that connection that I think the stress laid by Mr. Carmichael on the need for cooker demonstrators is very necessary. We in this country have a great deal to do in that connection, and I do thank Mr. Carmichael for putting his finger on the spot.

There is one thing that I do not quite see eye to eye with him about, and that is the suggestion that we should have one organization for the Industry here. I think the strong individuality of the ordinary Englishman, and, I would say, of our Institution, the B.C.G.A., and the National Gas Council, will enable us to function satisfactorily under the new Joint Co-ordinating Committee. I believe for this country that is far better than being under one Association.

Higher Average Price.

Mr. S. E. Whitehead (Southampton): My first thought on reading these papers is one of amazement that the authors should have been able to collect so much information in a three weeks' trip. Our difficulty, for a similar reason, is to discuss the papers adequately without asking a good many questions, and one could ask too many questions having regard to the brief character of the visit. We in the Gas Industry are all optimists, and I believe the papers give us a further justification for our optimism, because they have pointed out that there has been great development in a country in which gas is dearer and electricity cheaper than it is here. I am not quite clear whether that relative position as to cost applies throughout, or whether in the cities in the coalfields and nearer to the gas wells there is a more marked difference. I take it, however, that Mr. Carmichael means that the average price of gas is higher over the whole of the

country, and I notice that the average gas bill is also higher. Mr. Masterman has explained that by pointing out that the consumption per consumer, which is the most vital figure, is higher than in this country. The flexibility of charges obtaining in the United States is obviously a very great advantage compared with our position in that respect, but I could not ascertain from the paper whether the State Commissioners, who control these matters, also restrict or control the dividends. Perhaps Mr. Carmichael can enlighten us on that point. In these days of intense competition we are all agreed that it is hardly logical to place so many restrictions on dividends, and it would be useful to know what is the position in the United States in this respect.

With regard to common ownership of both gas and electricity undertakings in the United States, the author states that a "balanced opinion of the respective fuels" can be put forward. I do not know whether it is too much to ask what that "balanced opinion" is in the larger companies. It appears, at any rate, to include the surrender of all lighting to the electrical side. Rather in opposition to this the author later on in the paper points out that some appliances on the electrical side have been held back particularly by the electric cooker. I should have thought from experience in this country that the gas cooker was the one appliance which required least help in this direction. In other words, I should imagine that the advantages of the gas cooker were more apparent than are the advantages of gas for some other processes, particularly in view of the three points in this connection mentioned in Section IV. of the paper under "Publicity." May I suggest that a fourth point be added—namely, the greater use and control of the gas cooker, which, I think, is equally important with the other three points mentioned, unless in the States they already have a more easily controlled cooker. I know that coke is used largely for central heating, but it seems to me that coke must be a very difficult commodity to handle in the United States and similar countries, because many districts produce enormous quantities, while others, hundreds of miles away, not only do not make coal gas but require large tonnages of coke for the manufacture of water gas with which to dilute the natural gas. I should like to know whether that necessitates or brings about wide variations in price; or do the coke distributing companies, such as the New England Coke Company, which the author mentions, take responsibility for prices and marketing over a very large area? Some indication of the price of coke would be welcome, and particularly of the relative prices at which gas can displace coke for central heating.

The Candid Friend.

Mr. D. Fulton (Helensburgh): I think I might begin on a personal note and tell you that not very long ago Mr. Carmichael sent me an advance copy of his paper and in his note said, "Tell me candidly what you think about it." The candid friend, however, is attended with considerable danger [laughter]—danger to both parties, because if the situation demands candour the man who is demanding it may not always recognize the faithful one as his friend. In this case, however, there was no such danger. Perhaps it is a bit of an anti-climax to tell you that now, but I was able to tell him sincerely that I found the paper very interesting and provocative of thought. My re-reading of the paper since has not altered my opinion in any way despite his demand that I should take part in this discussion. It has always been said that travel broadens a man's outlook, and it has been the very happy thought of the President that we who were unable to travel should have our minds broadened by these three papers. Mr. Carmichael has courageously touched on several points which I think will cause a fluttering in certain dovecotes, but being of Scotch extraction I leave the particular dovecotes for you to guess.

As regards the unification of our national bodies, Mr. Carmichael gives quite strong approval to the adoption in this country of the American system of one National Body, and while I know that will be disputed I do know also that there is a strong favourable feeling in this country for such a measure. It may not be in the Industry itself so much as among the laymen who are members of Municipal Councils and possibly also of Boards of Directors of gas companies. I have often heard it stated that we are encompassed about by a host of Associations which apparently exist so that we may frequently transfer ourselves from the place where we work to more delectable quarters where we hold conferences and that the number of Associations is an excuse for frequent conferences. If it is true, as a philosopher said, that the desire for power is inherent in the human breast, then the identity of our National Bodies does contain the danger of conflict as to which shall be the uppermost in prestige and influence. That, I think, is really almost unavoidable, and so long as that is the case I do not think the work will be so well co-ordinated as it would be with a single managing director working through specific committees. Our experience during the war showed that nothing so effective was achieved as was done by the appointment of a Generalissimo controlling the whole operations of the war, and I think Mr. Carmichael has at least put forward a *prima facie* case which calls for exhaustive consideration and examination.

Then he shows how excellent results are obtained in Canada and America by the adoption of multi-part tariffs, and we in this country, I am afraid almost without thinking, have come to the conclusion that tariffs are the panacea for all our troubles. I think there is no doubt that our present methods of charging require to be amended in some way. Whether the amendment will come best through multi-part tariffs or through a block system of charging is open to argument. With multi-part tariffs I think it is a *sine quâ non* that there must be a minimum charge, but I cannot see a minimum charge being adopted by gas undertakings that are municipally controlled. That brings me to the question of municipal control which probably had very great advantages in the days when gas was more or less a monopoly, but I do not think to-day that municipal control can satisfy the conditions due to the intense competition, because decisions are not always based on the business circumstances but on political views, and that, of course, is not to the advantage either of the undertaking or of industry in the long run. If Mr. Carmichael is right—and I think he is—that we can obtain cookers at least equal in appearance, made of stamped steel, at a cheaper price, then we shall get something which we greatly need. We need not say that the present cast-iron enamelled cooker is too dear. It may be value for money, but that is not the point. We do require cheaper appliances if we are to maintain the sales of appliances. In my experience for some time back we have been doing much business in cookers with very great advantage to the undertaking, but the great portion of that business is for exchange work. We have to find the money and the staff, but the makers get the advantage, though we should be able to expedite that business if we were able to purchase the appliances at a cheaper price.

Unification of National Organizations.

Mr. T. H. F. Lapthorne (Chairman, Portsmouth Gas Company): I have just had a great shock. I had not the slightest idea that I should be taking part in this discussion, but I always take up a challenge if I can and I am glad to have the opportunity of saying that I associate myself, so far as a layman is competent to do so, with the views that Mr. Carmichael has expressed in his paper. I had the pleasure of being one of the party which, under the able guidance of our President, visited Canada and the United States, and I am sure the President will confirm me when I say that throughout we never had the slightest difference. To-day, however, I am going to venture one word of dissent from something that the President said in his Address. I hope he will forgive me. I want to associate myself particularly—and I do so from my own personal point of view and as an expression of independent opinion, and in no sense as an echo of Mr. Carmichael's words—with what he has said in the paper as to the advisability of unification of the existing national organizations. I am aware from the views that have been expressed hitherto that that view is not universally shared, but I hope and believe that it will be, in time, by some of the leaders of your Institution. I am aware of the difficulties in the way of unification, and these difficulties arise, in my opinion, largely from the fact that each organization has its own officials and staff, and unification, if it is to mean anything at all, must inevitably mean the displacement of some of those officials and staffs, an unpleasant thing always and difficult, but not insuperable; and if, as I believe, unification is advisable, no personal considerations should be allowed to interfere with it or prevent its realization. I believe, nay, I am sure, there is sufficient sense of justice in the leaders of the Industry that if unification comes the officials and staffs to whom I have referred will be perfectly safe to leave themselves in the hands of these leaders and know that they will get fair and even generous treatment. I think it helps to arouse interest in these gatherings if you get some expression of dissent from some quarters. I have just expressed my personal views, but I did have the opportunity last night of a word with my friend Sir Russell Bencraft, the Southampton Chairman, and I know he also shares my views. I have also reason to believe that others outside the technical men in the Industry are coming more and more to the opinion that I have expressed and which I have ventured with all deference to put before you to-day.

Mr. C. F. Botley (Hastings): It is inevitable in a matter of this sort that both the papers and the lines of discussion

should overlap but, as has already been mentioned, it was a most happy inspiration which led to the preparation of these records of impressions of America and Canada, and we are greatly indebted to those who have prepared them and not least of all to Mr. Carmichael. As time is short, perhaps I will take up the challenge of the last speaker and say that in my view there is no necessity for any further co-ordination in the Industry at the present time. In that connection I would remind you of the real purpose of the formation of the National Gas Council. That body was formed as the result of experience during the war, and it was of the constituent bodies consisting of the Institution of Gas Engineers, the B.C.G.A.—which was an infant of the Institution—the Society of British Gas Industries, and the Gas Companies' Protection Association, and if that fact is borne in mind it will be seen, in conjunction with the co-ordinating Committee now existing, that we have effective machinery to do our job properly always provided that the constituent bodies are entrusted with the duties which they are most competent to perform and that the offices of the various groups are efficient for the particular duties which are necessary. Therefore, the problem of getting rid of staffs does not arise, even if it were desirable. It is very important that we in the Institution should be clear thinking about this sort of comment, because it is a matter which in the interests of the Gas Industry should be resisted to the utmost, and you may depend upon it that so far as I am individually concerned I shall continue to resist it to the utmost.

There are, of course, very many points one would like to develop arising out of Mr. Carmichael's paper. I am sorry if I disagree entirely with him as to his impressions in America, but I do not think America is so much ahead on many things. I have heard reasons why there are not many slot meters in America and have always thought it was because they were such rich people there that they did not need to use slot meters. Now, apparently, according to the President, it is different.

Gas Charges.

There are one or two points in connection with gas charges. As the author has said, it is of vital importance that we shall as quickly as possible—if we have not already done so—consider alternatives to the flat rate system of charging. There are many alternatives—too many, unfortunately—leading to complications which are very undesirable, and mentioning for one moment Mr. Curtis's paper—which is to be read to-morrow—I should like to say quite definitely that there is no difficulty about a two-part charge. The standing portion of the charge can be quite definitely and plainly described so that it does not confuse any consumer. There is no need when we introduce another charge to make any allegations or suggestions about something, because we want to advocate any particular tariff. The two-part charge can be made simple, and the only difficulty is fixing what one part of the charge shall be. I was very interested in the President's references to the work of the Committee on Gas Charges, to which your colleague Mr. Ridley has made such considerable contribution by precept and practice. There are other representatives—besides Newcastle—who have been practising for years these other methods of charging which are essential if we are to retain the loads which are ours to-day and capture new loads. Do not let us imagine that we have not, very often, a certain amount of freedom. There is a good deal of opinion expressed that we cannot do this and we cannot do that, but the time has gone by when we can listen to these things. We must take our courage in our hands and go ahead and get business where we can.

Unity or Diversity?

Mr. J. H. Canning (Newport, Mon.): The suggestion that we should unify the Associations connected with the Industry has certainly produced a difference of opinion, and I should not myself like to express an opinion definitely on the matter as I think it should receive the most careful consideration. There are some considerations which we must take into account. The advantages of unity are obvious, of course, to anybody, but perhaps we may find that there are many advantages in the diversity of Associations which we now have, and I think we may be trusted to think the matter out for ourselves. Another point which I think should be taken into account is the fact that we began on the American system. I am not old enough to remember it myself, but I have heard about it from my father and other older men in the Industry. In 1882 we had the Gas Institute which embodied, I think, practically all the interests connected with the Gas Industry. As is sometimes the case, however, that produced conflicting interests, and you got a species of internal strain or friction set up, and that happened in this case. Therefore, in 1891, unfortunately just at the time electrical competition was beginning to make itself felt, there was an unfortunate split which lasted for about twelve years. That split has been healed; and I think, largely as the result of experience, it has been thought wiser to proceed on the lines along which we are working to-day. I certainly would suggest that it is a matter which should receive very careful consideration at the hands of the bodies and interests concerned.

With regard to the question of the stamped steel cooker I saw a great many of these in America, and I must say that they did not altogether appeal to me. Our friends over there call our cookers " safes," but, at any rate, I do not think the workmanship was equal to ours, nor do those cookers appear to promise the length of life which the English cooker has.

As regards methods of fixing rates, I do not want to say anything unfriendly or even critical of our friends on the other side, but I do not think they ought to get too much credit for that, because they have been helped very largely by legislation. Had we the same authorization from Parliament, I am sure—although I do not say we should be as good as they are—that we should be able to fix rates much better than we do to-day. I feel very strongly that the Industry has not been properly treated by Parliament, and we ought to have the same freedom as our competitors in fixing rates and in securing business.

Mr. W. B. McLusky (Halifax): Dealing with Mr. Carmichael's conclusions:

(1) I agree with Mr. Carmichael that our National Organizations should be merged into one body.

(2) The amalgamation of the smaller undertakings suggested in the paper would strengthen the undertakings and promote service and sales.

(3) The method of fixing the price of gas in this country leaves room for immediate improvement, and I wish that the municipalities who are free to quote more equitable terms would proceed with the good work, and set an example that would convince those in authority that equal freedom should be extended to statutory gas companies.

(4) *Mechanization of Office Work.*—We have before us the examples of Newcastle, Glasgow, Belfast, and other Gas Undertakings, where a measure of mechanization has proved highly efficient and profitable.

(5) Technically trained demonstrators and salesmen are an asset to any gas undertaking. The new business is self-supporting. We have, on occasion, loaned members of our staff for short periods to smaller undertakings. The results have proved the value of the service, and some of these undertakings have now, as a consequence, established a staff of their own.

(6) *Service to the Consumer.*—In Halifax, the distribution of gas, in which is included service to the consumer and the sales and demonstration services, represents an expenditure of 1¾d. per therm. The corresponding figure twenty years ago was ½d. per therm. No expenditure is so valuable to the consumer as expenditure on service.

(7) Pressed steel cookers would, I fear, not give results equal to the high standard maintained by our British manufacturers. Lighter appliances would reduce the cost of transport. Pressed steel or preferably iron cookers would have quite an elegant appearance, and would serve the purpose until the oven door began to warp and leak: but if the price could be made low enough to make replacement possible at intervals of five years, we should be able to satisfy those who like a change, and, as our great Dorsetshire novelist, Thomas Hardy, said, " There is nothing so permanent as constant change."

(8) The help and guidance received from the United States of America are greatly appreciated in this country, and I wish to put on record here my acknowledgment of the stimulus which I have experienced in my association with many friends in the United States and Canada, particularly Mr. Douglass Burnett, of Baltimore (our first colony, if my memory serves me right), and Mr. Theodore V. Purcell, of the People's Gas Light Company, of Chicago.

Finally, in all calculations made for the purpose of arriving at the amount of dividend to be paid to the shareholders of a Statutory Gas Company, allowance should be made for all expenditure incurred in service to the consumer, including maintenance of consumers' fittings and burners, demonstrations, and advertising and selling, for all these services are worth more to the consumer than the amount of money expended. In other words, it is better to spend the last halfpenny on work of this kind than to reduce the price of gas by a halfpenny.

Mr. Carmichael said that he would reply to the discussion in writing, and thanked the speakers for what they had said.

Correlation of Costs and Gas Charges with Particular Reference to Working Results at Macclesfield

By H. CURTIS,

Engineer and Manager, Macclesfield Corporation Gas Department.

The PRESIDENT: I am sure the members are very much indebted to Mr. Curtis for this excellent paper. It is bristling with points, and is written at an appropriate time when this question of rates and charges is very much in the air. I was rather amused and interested by the conclusions which he mentions. I do not want to be cynical at all, but he sums up the position as he sees it as regards the seasonal differential charging system under eight headings, and if one is optimistic enough to accept these then it is the Open Sesame to the Gas Industry, it is the cure for all our ills. [Laughter.] However, the author has given us an excellent paper, and we are most anxious to have a good discussion.

Mr. J. E. BLUNDELL (Carlisle): In opening the discussion on Mr. Curtis's paper, I must first acknowledge the graceful compliment paid to Mr. Belton and myself. Mr. Curtis's paper cannot fail to arouse very considerable interest in the Industry. His vigorous sales policy, coupled with his energetic measures to extend and maintain the efficiency of his manufacturing plant, has been rewarded with an extraordinary degree of success. He very rightly disclaims any intention to suggest that his particular scale and type of gas charges would meet with the same success in other circumstances. The simplicity of the method cannot be denied, but is it not, perhaps, a little *too* simple for some of the better-class of domestic consumers?

One can see that, in the case of the prepayment consumer, a discount method must be very popular. It is based upon sound psychology. But there would appear to be still something to say for at least a two-part tariff for the bigger domestic consumers and for the industrial consumers. People of this class are accustomed to deal with, and to appreciate the difference between, on-cost and production-cost, between standing charges and manufacturing charges; and they generally like to know where they are, as between these two components of the cost of supplying them with gas or any other similar commodity.

There is, of course, a difficulty in fixing the standing charge on a basis which will be at once acceptable to the consumer and satisfactory to the supplier. Any assessment of the service charge is liable to be arbitrary, or, what is much worse, to give the impression of arbitrariness to the consumer. For instance, in the electrical industry it is quite usual to make the standing charge a percentage of the rateable value of the house. Such a method may give rise to anomalies which exasperate the consumer. Assessments for rates are sometimes changed, generally in the upward direction, and the consumer cannot see why he should submit to an increased cost for electricity, or gas if such a system were adopted by the gas undertaking, just because he is also called upon to pay more rates. On the other hand, the consumer, with some business instincts, smarts under a sense of injustice when, having increased his demand for gas to two or three times that of his neighbour, he is charged at the same flat rate. He feels he is paying his share of the overhead charges two or three times over.

BASIS FOR SERVICE CHARGE.

The difficulty is to find some simple, equitable, and generally applicable basis for the calculation of the service charge, particularly to domestic consumers other than those with prepayment meters. For the latter case I do not think Mr. Curtis's system can be greatly improved upon. And, in the former case, the solution of the problem should not be impossible.

The thanks of the Institution are due to Mr. Curtis for the very fine set of figures he has placed at our disposal. These figures exhibit an undertaking in a very sound and prosperous condition, with all the elements of future success. Mr. Curtis is obviously in a fortunate position as regards capital employed, and it is evident that this has been an important factor in rendering possible the handsome reductions in the price of gas which he had been able to make. I notice that there has been practically no increase in the capital since that of 1925. He must therefore have been able to carry out a considerable amount of remodelling, equivalent to extension, out of revenue. Perhaps Mr. Curtis will explain this further. Certainly, gas at 3d. per therm will leave very little room for the electrical competitor to get in, provided that it is backed up by efficiency and assiduous service.

There is just one other question I should like to ask. How does Mr. Curtis manage to carry out, to the satisfaction of consumers, the change-over from the winter to the summer rate of discount? There must be a certain amount of overlapping requiring some ingenuity on the part of the collectors to ensure that each consumer gets his fair share of the discount at the higher rate.

PAYING AS LITTLE AS POSSIBLE.

Mr. T. P. RIDLEY (Newcastle-on-Tyne): The Institution should be grateful to Mr. Curtis for submitting his paper on a subject which to-day is of the greatest importance to the Gas Industry. It shows remarkable achievements in sales and reductions in net prices; very few can say that their average price of gas has been reduced by one-half during the last 10 years. Mr. Curtis is to be congratulated upon his achievements. I agree with him that consumers are not interested in the equity of the distribution of overhead charges and that the consumer is mainly interested in paying as little as possible, but I do think there are methods of charge which, while working out to the same average net price as other methods, are more likely to assist the salesman in inducing the consumer to make a greater use of gas—that is to say, methods having a psychological appeal. The whole object of Mr. Curtis's seasonal differential charging system was to increase the summer load more than it could be increased by any other system.

Mr. Curtis admits that he was greatly surprised that the levelling up of the load factor was not realized to any great extent. Considering the very great difference between summer and winter net prices I am also surprised. I think that reduced prices or reduced block quantities in the summer for domestic and public lighting consumptions are advisable, but I feel the Macclesfield difference is too wide. It cannot be justified by the cost of the winter peak seeing that normally about 40% of the total sales is in the summer six months.

Apart from equity, so wide a difference has the disadvantage of making the winter accounts, with the naturally greater consumption, too heavy by comparison with the summer accounts, which is unsatisfactory to the consumer, and further it is a handicap in fighting the lighting and heating competition. It also gives full benefit to uneconomic as well as economic consumers. Mr. Curtis states that the increase from 1928-33 in the summer sales is 27·8%, and in the winter 17·6%, but reference to fig. 6 shows that each percentage represents the same volume of gas—namely, 39 million c.ft.

I find that during the same period the increases at Newcastle were:

Summer	340,000 therms
Winter	85,000 therms

Therefore, the summer volume increase is four times that of the winter increase; and, without seasonal differentials, has improved the summer load to a greater extent than has been the case at Macclesfield. I also find the same trend of improvement in summer load in two small companies with which I am connected. I would therefore ask Mr. Curtis if he is quite sure there have not been some special circumstances to account for the comparatively small improvement in the summer load at Macclesfield in view of the great inducement in price.

Mr. Curtis does not claim that the annual increase in sales experienced at Macclesfield would necessarily be repeated by the application of the seasonal differential system elsewhere. I think he would not seriously disagree with me when I say that equivalent success might have been attained at Macclesfield on some—not necessarily all—other systems which resulted in the same low average net price per therm. Mr. Curtis would probably also not disagree with me in stating that a discount system is not the only system which can be available to every consumer. A block system can be equally applicable and could also include the power consumers. I would like to ask Mr. Curtis why he does not favour the block system as against the step-rate system with the latter's inevitable marginal anomalies which have necessitated the supply to every consumer of a ready reckoner which may or may not be kept in such safety that the consumer can always put his hands on it for checking up his account. The discount system

could have been tied up to the block system and the ready reckoner dispensed with. The block system is simple, easily understood, and gives its benefits to the economic consumers. Our experience with a two-part tariff and block rates is that the only price which is taken into consideration when discussing the development of sales is the price at which that particular gas will be charged. The service charge and the previous block prices are not taken into consideration, and thereby sales are made easier. With the amount of revenue which Mr. Curtis has been able to release, in my opinion a very attractive block-rate system could have been evolved which would probably have resulted in most of the industrial load being continued during the winter.

I do not agree with Mr. Curtis's objections to the two-part tariff except that it must of necessity be optional, nor that too much stress has been laid upon the position of the unremunerative consumers. I do not think it has been sufficiently ventilated. We might otherwise have obtained powers for minimum charges.

I agree with Mr. Curtis that it is difficult to devise any system which could with advantage be universally applied, owing to the widely different conditions of (*a*) existing scales of charges, (*b*) classes of consumers, and (*c*) the financial position of the undertakings. I would go further and say it is not desirable to attempt to do so. Each undertaking must consider its own circumstances and decide what system is most suitable in its own area. If we were a new industry the position would be different. In some cases it is desirable to have more than one method of charge in addition to the flat rate which we must have. One electrical undertaking with the tariffs of which I am familiar has six, and on no two methods is the cost the same for a like quantity of current. In addition, it makes individual special contracts for industrial and commercial purposes at all kinds of prices. Mr. Curtis has introduced a seasonal differential tariff, and whether it is due to the form of tariff or to the very low average price there has been undoubtedly an excellent and exceptional increase in sales.

In Newcastle we have found a two-part tariff excellent for our large industrial consumers but unattractive to the large majority of domestic consumers, who represent 92% of the total number of consumers. To modify it to make it attractive would involve too great a loss of revenue. It has been found necessary, therefore, to consider some other tariff for domestic consumers which will, after a comparatively small consumption, give a substantial reduction in price and which can be applied without having to obtain individual consents. I consider that before long, by pressure of circumstances, there will be introduced up and down the country numerous tariffs, many of which will not be scientific, but expedient dictated by competition, because attractive terms must be offered more generally.

The PRESIDENT: I am sure we should like to have a few words from Mr. Fottrell, who has given such great study to this subject.

Mr. E. J. FOTTRELL (National Gas Council): In venturing to intervene in the discussion upon this subject I have no intention of criticizing what Mr. Curtis has said. I think many will agree with Mr. Ridley that there is no single subject of more importance to the future of gas development than the subject which is indicated in the title of this paper, the correlation of costs and gas charges—*i.e.*, the framing of charges which do make some serious attempt to take into consideration the cost of any particular supply. I think Mr. Curtis has shown that he had achieved the true objects which he had before him; but, as a matter of fact, I think that the curve showing the monthly output, unless carefully examined, does not quite do justice to what he has achieved. If one works it out one finds that although the winter peak has increased to a larger extent than the summer valley has decreased, nevertheless he has raised the production load factor, based on the monthly maximum output, from 66% to 75%. However, as I say, my object in intervening in the discussion is only to suggest a possible means to those who would like to follow the example which Mr. Curtis has set. Mr. Ridley has already referred to one. I was rather puzzled to know why Mr. Curtis, having chosen a block-rate for his industrial consumption, has adhered to the step-rate with regard to his ordinary consumers. Probably this is not the proper occasion to discuss the relative merits of the two, but I feel that at any rate one minor advantage of the block-rate is that it eliminates the necessity for marginal relief, the explanation of which occupies quite a considerable proportion of the statement of the charge itself.

A second point is that unless and until we can secure powers to make a minimum charge I think we must agree, at any rate in respect of small initial quarterly consumptions, that it is the proper policy to maintain the rate of charge as high as possible. Whether 7½d. per therm in the case of small consumptions is or is not an economic charge is possibly debatable, but when it comes to 7½d., less 50% in the summer period, or 3¾d. I do not think there can be any doubt that in relation to the small consumer it is a totally uneconomic charge. My suggestion, therefore, to those who might take advantage of the experience of Mr. Curtis, and would like to follow in his footsteps with regard to a seasonal differential charge, would be that the seasonal differential should not apply to the charge that is made for a small initial quantity in the summer period. In other words, there should be throughout the year a uniform charge for the first initial block. Really the two suggestions hang together, because, with the block system in operation, the two suggestions really become one.

THE BEST IN THE BLOCK TARIFF.

Mr. W. B. MCLUSKY (Halifax) said: Mr. Curtis's scale is not a block tariff. A block tariff has a high starting price. Mr. Curtis's scale embodies the best in a block tariff, and excludes the worst. Mr. Curtis's scale embodies some of the better features of the old discount system, with none of its disadvantages. The old discount system started with a moderate maximum price, but in the block system the high starting price is forbidding, and, unfortunately, in competition, this figure is often quoted as the price of gas.

The block tariff, at first sight, seems a nice, easy, and simple way of collecting a concealed service charge, but it fails in its purpose, because the amount concealed in the first block is not enough to provide the necessary service charge, and yet it is more than the price of gas can carry. The trouble does not end there, because none of the prices in the early stages of the block tariff is low enough to attract business. Mr. Curtis's scales, from start to finish, are low enough to attract business. Where circumstances make it impossible to quote the prices at which gas is sold in Macclesfield, a multiple tariff scheme is necessary—a scheme that puts the price of gas before the customer at, or as near as possible, 3d. per therm.

In this country there are eleven undertakings selling gas at 6d. per therm, or less, without any service charge. In addition to these, there are three undertakings selling gas at prices ranging from 6·4d. to 6·6d. per therm.

		d.
(1)	Middlesbrough	4·23
(2)	Kirkintilloch	5·3
(3)	Aberdeen	5·4
(4)	Bath	5·5
(5)	Haworth, Yorks	5·6
(6)	Helensburgh	5·7
(7)	Belfast	5·77
(8)	Darlington	6·0
(9)	Sunderland	6·0
(10)	Sowerby Bridge	6·0
(11)	Plymouth	6·0
(1)	Merthyr Tydvil	6·4
(2)	Penrith	6·6
(3)	Sheffield	6·6

The big question for those who must have a service charge, in addition to a low commodity price, is how to assess the service charge.

SIMPLICITY.

The Macclesfield scale has the merit of simplicity. No survey is required; no assessment of consumers' premises; no ascertainment of the hourly demand. But the consumer of Macclesfield gas who buys 125 therms per quarter has contributed a service charge of 23s. 9d. in a nice, quiet way. Of course, Mr. Curtis gives him a discount of 7½% in the winter time, and 50% in the summer time, but even this generous summer discount only reduces the 23s. 9d. to 11s. 10½d., which is 4s. 1½d. above the average amount of 7s. 9d. required. When this system of charging was first introduced 29 years ago, the Norwich system—½d. per unit *plus* 10% more or less on the rateable value of the premises—was taking root. This scheme received a cold reception at the start. People objected to paying what they called "something for nothing"—a service charge. But the Norwich system is free from the flaw in the old parcels scale, which preceded it, and which is now doing so well in Macclesfield. The flaw in the parcels scale is that it treats every customer alike—rich and poor, small and great. The Norwich system—multiple tariff—discriminates between one customer and another, between a large hourly demand and a small hourly demand, between a large house and a small house.

Mr. Curtis's scheme retains in Table II. the best characteristics of the original parcels scale, but Table III. is expressed differently. If Table III. were expressed

in the same form as Table II., there would be no need for marginal relief, and the scale would read as follows:

First 40 therms, 7½d.
Next 60 therms, 7d.
Next 150 therms, 6½d.
Over 250 therms, 6d.

Macclesfield has made a mark. Mr. Curtis is at the top of his class. The overhead charges in Macclesfield are low, the increased consumption of gas, and particularly the remarkable increase in the summer period, has reduced the incidence of the overhead charges. This increase must be placed to the credit of the management—good management over a long period of years, combined with a wise and persistent sales policy.

The sale of gas per inhabitant in Macclesfield is 11,800 c.ft. This figure is exceeded only by:

Plymouth, 13,000;
Bangor, Co. Down, 13,100;
Helensburgh, 14,200;
Scarborough, 14,200; and
Bath, 15,200.

The average consumption of gas per consumer in Macclesfield is 38,200 c.ft. per annum. This figure is exceeded by only 16 undertakings in Great Britain and Ireland:

Kirkintilloch, 38,300 c.ft.
Lea Bridge, 38,700.
Scarborough, 38,730.
Cambridge, 39,230.
Plymouth, 39,460.
Windsor, Berks., 39,870.
Stratford-on-Avon, 40,690.
Oxford, 40,810.
Bangor, Co. Down, 42,300.
Birmingham, 44,210.
Goring, 45,650.
Weston-super-Mare, 46,100.
Bournemouth, 47,400.
Reading, 48,880.
Helensburgh, 52,030.
Bath, 53,600.

It is noteworthy that in a neighbouring town in Cheshire, with a population of 35,000 inhabitants, the sale of gas per inhabitant is only 2,700 c.ft. per annum. It will be observed that the health resorts have the largest sale of gas per inhabitant, and average consumption of gas per consumer. Next in order come those pleasant industrial towns with large residential areas combined.

Discounts.

A block tariff and a discount can have the same effect on the gas bill, but perhaps not the same effect on the consumer's mind. For example, if you sell the first 2,000 at 5s., the next 3,000 at 4s. 6d., the next 4,000 at 4s., and the next 5,000 at 3s. 6d., the consumer might be quite satisfied. But he might be better pleased if you offered him discounts of 10% off the second block, 20% off the third block, and 30% off the fourth block, which would make the price to him exactly the same. In the discount system, the consumer sees only the one figure—the price of gas—to which he gets accustomed, just as consumers of electricity get accustomed to the high charges which electrical undertakings impose upon them for electrical energy. The high price—once the consumer has got accustomed to it—*plus* a large discount, appears in some quarters to attract business, but I have never had any experience of that kind of business. In all my experience I have found it better to name the price at the start—3d. per therm if you can afford it, and a service charge distributed according to the size of the premises for domestic purposes and according to the maximum hourly demand for industrial purposes.

The average cost of the commodity in Macclesfield is 3·075d. per therm. The average price received is 5·356d. The difference between these two figures is 2·281d. per therm. The total receipts amount to £39,231. The cost of gas into holder absorbs 3·075d. per therm, or £22,351. The difference between these two figures is £16,880 for the year. This figure of £16,880 divided by the number of consumers supplied gives an average of 7s. 9d. per consumer per quarter. Mr. Curtis and his Committee have decided that it is better to conceal the service charge in the "all-in" price of gas, and who shall say they have not acted wisely?

Discounts.	Total Amount.	Less Discount.	Net Amount.	Average Price per 1,000 Cu.Ft.
1	2	3	4	5
	s. d.	Per Cent.	s. d.	s. d.
2,000 cu.ft. at 5s. . . .	10 0	..	10 0	5 0
3,000 ,, ,, 5s. . . .	15 0	10	13 6	4 6
4,000 ,, ,, 5s. . . .	20 0	20	16 0	4 0
5,000 ,, ,, 5s. . . .	25 0	30	17 6	3 6

All gas consumed in excess of 5,000 cu ft. per quarter—75 per cent. discount, which equals 1s 3d. per 1,000 cu ft., or approximately 3d. per therm.

Mr. F. C. Briggs (Dudley): Mr. Curtis's paper gives particulars of still another, and very interesting, method of differential gas rate charging. Macclesfield Corporation and Mr. Curtis are to be congratulated upon their courage which is exemplified not only by the adoption of a new and untried method of gas charging, but for their increasing immediately the price of gas at the time of the general strike which put them in the very happy position to give consumers considerable advantage in price after the strike was cancelled. But while congratulating Mr. Curtis upon his courage and the frankness with which he has put the vital statistics of his Undertaking before the Institution in his paper, for which the Institution is very much indebted, I feel personally that I cannot agree that he has proved his case. The seasonal variation of load is not the entirely unmixed evil the paper might imply. Mr. Curtis does mention casually the question of overhaul, but this seems to me of much more importance than he has allowed it to appear. Certainly as far as retort plant is concerned my own present seasonal variation is only just sufficient to enable overhauls to take place.

Without going into figures, I rather doubt if any less plant in total could be employed than is needed now even if my present yearly load followed an absolutely horizontal line graph, if the necessity of overhaul is borne in mind; although I agree that the time of repair could sometimes be more conveniently chosen. The capital cost of manufacturing plant can be the only overhead charge that can be claimed to be affected by seasonal load. I have suggested that this is not appreciably altered by a flattened monthly load curve. All other overheads will be reduced by increasing consumption whether the increase is obtained in summer or winter. It must be remembered that with most undertakings, as far as mains are concerned, the peak is still Sunday dinner time in July or August; and as far as consumer service is concerned every increase in the domestic load whenever it occurs will bring its additional increment of cost. The increment will be less than that of existing consumption, but it will be irrespective of season.

Flattened Hourly Load Curve.

I suggest a flattened hourly load curve is much more important than a flattened monthly load curve. In the conclusion of his paper, Mr. Curtis says that the figures put forward show clearly the effect of a more balanced load in the reduction of standing charges per therm. I suggest that this is not proved. In Chart 6 is shown the increased percentage of summer increased consumption over winter increased consumption. I rather feel that a percentage comparison in this matter is somewhat misleading. The actual cubic feet increase since 1927 has been very little more in the summer than in the winter, and from the graphs given in fig. 5 it appears that the winter peak load in 1933 shows, in fact, a very much greater increase than the summer peak load in comparison with the year 1922-23.

I am glad Mr. Curtis has not spoken of scientific rate tariffs. Nothing to my mind is less capable of real scientific handling than the making of rate tariffs. There are so many uncontrollable factors that defy accurate analysis; and it is almost impossible to assign an effect to one particular cause. In the short time available since Mr. Curtis's paper came into my hands, I have charted my own Company's monthly gas output figures for a number of years. I find my graphs very much akin to those of the author although somewhat flatter, and the flattening out of my graphs since 1927 has been rather better than the author's, although no seasonal differential rates were in operation. Mr. Curtis has adopted a somewhat voluminous gas charge table to give a smooth curve gas price, but I feel this is somewhat clumsy and makes it very difficult to answer a consumer's inquiry, "What is the price of gas?"

Exactly the same result can be achieved with greater simplicity of a block rate arranged in sections, according to consumption, under which only two prices appear upon any gas account, and it is quite easy to quote a therm price to any consumer, the price of the first block in any section being the average price of all the blocks given in the preceding sections. Mr. Curtis apparently has no special price for industrial consumption other than by gas engines, and the seasonal discount must therefore apply. He states that the lower price in the summer enables him to enter certain competitive fields which otherwise would be closed to him. I agree with there being no special industrial price if a steep block system is used, but I feel the wide variation between summer and winter prices would be found in most areas very objectionable to industrial consumers, and very few of them would be found willing to expend capital on plant for use in summer only, if the winter price of gas were not also competitive.

The method set out in the paper entails a very large rebate to prepayment meter consumers in the summer. This

I think restricts gas usage. There are certain advantages in rebates on slot meters, but it is my experience that the nearer the true price charged to prepayment consumers is to the rate at which the meters are set the larger is the yearly revenue obtained from such meters. The author touches upon the difficulty of introducing two-part tariffs. The difficulty, of course, facing so many undertakings entirely desirous of introducing more steeply graded rates is the utter financial impossibility of doing so.

When gas prices have been kept low to meet competition, it is impossible to introduce any attractive price scheme without increasing the price of the first block above the existing price, which at this time of falling prices is almost impossible. The change only becomes possible when by rapid increase of consumption without capital expenditure, or change of manufacturing plant producing considerable economy, a financial surplus becomes available; and as has been suggested, I believe, by the National Gas Council, in such cases it appears to be extremely important both in the interests of the undertaking and the Industry that the introduction of a block system should be seriously considered.

An Enviable Position.

Having adopted such a system a two-part voluntary alternative becomes a possibility, and is in my view not only very desirable, but is in no way more arbitrary in the incidents of its charges, nor more difficult to apply and understand than the suggested seasonal tariff. But although Mr. Curtis has, I consider, not made his case either for the desirability of a constant monthly load, or that this method of charge has achieved such a result, I think he has made a very good case for cheap gas, and he is certainly much to be envied for the position in which he finds himself in this connection. Since 1923 his average price realized has gone down from 11·8d. to 5·4d. per therm, and his gross cost from 8·6d. to 5·2d. per therm—a very remarkable achievement that leads one to scan his figures with considerable interest and not a little envy. On the way to this consideration one must congratulate Mr. Curtis upon the excellent figures of make per ton of 102 therms, and of unaccounted-for gas of only 2·8%. But turning to Table V., one notices some very low figures for repairs, notably repairs to works 0·5d. per therm, and repairs to mains and services at 0·3d. per therm; the cost of repairs to meters at 0·5d. per therm is probably about normal, but the only distribution costs other than mains and meters is given as showroom 0·04d.

Does Mr. Curtis have no general cost for attention to consumers' requirements, no burner cleaning, and no attention to appliances upon hire and hire purchase? He speaks of the free hiring of appliances of the past which he condemns, with which condemnation I agree, but from fig. 2 he still has apparently some 5,000 Corporation appliances in use on his district. Where does Mr. Curtis include the cost of the necessary attention to these?

Finally, Mr. Curtis is in the happy position at the moment of having only 0·5d. per therm interest and sinking fund charges. Part of the reason for this, I think, can be gathered from his Table VIII., where he compares the circumstances of eighteen undertakings of approximately similar size.

Macclesfield does not seem to have been faced with the development of housing schemes upon the fringe of its area which so many undertakings have. One undertaking in his table has apparently had an increase of 96% in its number of consumers in seven years. If this has not been by amalgamation, the interest account for that undertaking must have of necessity shown a much more difficult position than Macclesfield's. This rapid increase of municipal housing schemes also usually reduces the sales per consumer and per mile of main.

I think the real moral to be drawn from the paper is that cheap gas will sell more gas, but that when cash surpluses are available for reducing prices, better results can be achieved by some differential rate method than by a flat rate reduction upon an existing flat rate scale. I venture to suggest, however, that the multiplication of methods of rate charge may, by the confusion arising, become a weakness in the Industry.

The National Gas Council is now collecting information of the actual methods in use at the moment, and I feel that upon completion of that list it would be highly desirable for an authoritative committee to consider the matter and make recommendations with a view to guiding the many undertakings now considering this matter, in order that the number of methods in use should not be unduly increased. I agree with Mr. Curtis as to the difficulty of devising any system of charging which can be universally applied in view of the widely varying conditions under which gas is supplied, but I do not think these conditions vary so very widely as do our own individual opinions on the subject.

Co-ordinated Policy.

Mr. H. E. Bloor (York): I just want to offer one remark on this matter which Mr. Briggs touched on in his last few words. I have found that public authorities and state authorities have found relations with the Gas Industry very difficult owing to the enormous differences in charges for gas and the supply of appliances, and there is no doubt that a co-ordinated policy with regard to gas prices throughout the country would be, in the long run, a very great asset to the Industry. It does seem that the Industry in the next year or two will be engaged in inventing and putting into operation two-part and other tariffs following on the passage of the Bill now before the House, and it would seem a great pity if the opportunity of putting gas charges on a somewhat more rational basis throughout the country were to be lost. With regard to these charges and this rational basis, I wish to formulate the following question: Just precisely what load which we have not now got do we hope to secure by the adoption of two-part tariffs? Looking at our Industry for a moment as a domestic industry and forgetting the industrial load, we have functioned hitherto on the basis of supplying the intermittent requirements of the household. We have supplied light, and where we have had that load we have had the continuous and complete requirements of the household for lighting. Outside that, however, gas has been recognized hitherto as an intermittent source of heat for intermittent purposes. When any consumer of gas asked whether he could use gas for some purpose requiring continuous use, we have always told him that gas was too dear for that purpose and recommended him to our coke office and suggested that he should order some coke. I do suggest, however, that what we require now to ask ourselves is whether we are out to secure the continuous heating load of the house which requires many times the number of therms that intermittent uses do, and, if we do desire to secure that load, then we must adopt a commodity charge which will enable the consumer to use gas in direct competition with solid fuel. Unless we achieve that purpose it seems to me that we shall not benefit by introducing two-part tariffs. In this connection I would like to recommend a study of the figures which Mr. Haynes, of Rotherham, has been able to secure, showing with very great accuracy the number of therms of gas required to replace 1 cwt. of coal for the average household. That figure has been obtained at Rotherham, and I hope everybody will study it very carefully, because it does seem to give us some rational way of tackling this problem and of pricing gas to secure the continuous heating load in competition with solid fuel.

A Good Case.

Mr. C. S. Shapley (Leeds): I have read this paper with considerable interest. Mr. Curtis has made out a very good case and is to be congratulated on the results he has obtained. An increase of 25% in 1933 over the 1928 output, the date when the scheme was first introduced, is undoubtedly a very fine achievement. The Chairman of the Macclesfield Gas Committee is reported to have stated that in his opinion "It will not be long before this method is followed by many other concerns in the gas world, and possibly also in the electrical world." My opinion, however, is that such a scheme can only be introduced where an undertaking is able to make a considerable reduction in gas charges, without creating an adverse balance-sheet.

There must be many gas undertakings, including Leeds, that could not face a reduction of 50% of their summer revenue, and I observe that it has taken Macclesfield from 1928 to 1933 to increase their total load by 25%. I agree with Mr. Curtis that one of the benefits of his scheme is that he has succeeded in making his consumers "gas-minded," and they so appreciate the value of gas appliances that they continue to use them in the winter, although the cost of the gas is doubled. Mr. Curtis shows an increase of 27·8% in summer and 17·6% in winter, but what is not quite clear to me is by what means the gas consumption has increased. For instance, Table VII. shows that Consumer A, using gas and coal, consumed 5,600 c.ft. in the June quarter, 1932. After changing over to all-gas, his June quarter, 1933, increased to 32,800 c.ft. This is a very interesting example, and I should be very pleased to know further details, such as the number of rooms in the house, and what additional appliances were installed to account for this large increased consumption.

We have in Leeds 71,000 consumers who only use 2,500 c.ft. or less per quarter. Owing to the circumstances under which they have to live, the great majority of these have no capacity to increase their consumption. Any reduction of price to this class of consumers would only mean a loss of revenue to the Department, without the least chance of

recovery. The summer consumption represented is 215 million c.ft.

I am interested in the experiences of Mr. Curtis with regard to simple hire. My own are similar; we abolished it in Leeds in 1928 and have found that our business has not suffered in consequence.

Theory of Seasonal Discounts.

Mr. J. T. Haynes (Rotherham): Whatever opinions one may have concerning the theory behind the scheme of seasonal discounts there is no denying the fact that it works—and in Macclesfield it works successfully. The Macclesfield Corporation and their Gas Engineer, Mr. Curtis, the Author of the Paper—are to be congratulated on the results achieved. In a discussion on such a paper one could criticize a large number of points all of which can no doubt be explained satisfactorily by Mr. Curtis, but this is not the time for a carping criticism—constructive effort is required.

The original object of the scheme was to fill up the summer hollows in the sales of gas. It has actually raised the winter peaks as well as the summer hollows, and Mr. Curtis has to admit that his object was not realized to any great extent. But if this is to be construed as failure then there is little hope for the Gas Industry.

It is observed that the increases in gas sales since the scheme was put into operation in 1928 are approximately only the same as those prior to 1928. This may seem to be a weakness, but one asks if the earlier increases would have been continued at all if there had been no scheme in operation. All too many undertakings have had no scheme—neither have they had any increases! Mr. Curtis has a number of objections to two-part tariffs. All but one of his objections—that about the regular collection of overheads—are actually arguments favourable to tariffs, but as he is not likely to be converted, from this platform, I will refrain from entering into a wordy warfare which would only provide matter for the armchair critics.

That two-part tariffs, properly applied, do achieve results as good as, or even better than, those of Macclesfield is indicated by the results already achieved in a few months at Rotherham. Of 253 prepayment and 140 ordinary consumers who have signed two-part tariff agreements, 152 (or 40%) previously used less than 17,000 c.ft. per annum, the town's average domestic consumption. Their new average is estimated to be 45,000 c.ft. per annum, while 84 consumers (or 21%) already have entirely displaced coal by gas—and I see no reason to be ashamed of the financial position.

An Analysis.

As a matter of interest I have analyzed some of the financial statements submitted by Mr. Curtis in Table V. I have used the "Rotherham" two-part tariff formula which has been submitted to the National Gas Council, and which I understand will be circulated to the members—or at least to those sufficiently interested to ask for it. With that formula I drafted a scale of two-part tariff charges for Macclesfield and applied them to cases A and B given by Mr. Curtis in Table VII. The total cost of gas to the consumer under two-part tariff works out to within a few shillings of that actually charged by Mr. Curtis. But under two-part tariff terms the consumer has a greater opportunity to buy cheap gas both summer and winter, and so greater consumptions are possible.

Under two-part tariff also the prepayment consumer gets his full quantity of gas for each penny placed in the meter. In summer Mr. Curtis only gives him a ha'p'orth of gas for a penny—and gives the other halfpenny back as rebate. I wonder what is the psychological effect of the two methods. And, in spite of what Mr. Curtis says, the public is accustomed to think in terms of the commodity charge—*e.g.*, halfpenny electricity. I happened to show these notes to my wife and she said she liked Mr. Curtis's method better than mine—she would feel she was getting such a bargain during the summer sales.

Whether or not one favours two-part tariffs, block systems, or seasonal discounts is, to my mind, of less importance than the will to do something and to do it thoroughly, and I suggest that it is time that the National Bodies gave a lead in this matter. What a glorious opportunity for the new gas corporations with their improved facilities and organizations! I am assured on good authority that under existing legislation there is nothing but the fear of the unknown to prevent any municipal authority or private company from adopting an optional two-part tariff if they really want to do so.

I again add my congratulations to Mr. Curtis and the Macclesfield Corporation—not so much on having increased their gas sales as on having got out of the rut, and for having done something while so many others are content to criticize and talk.

No Mean Attainment.

Mr. A. L. Holton (Manchester): The author is to be congratulated upon the success which has been achieved by the adoption of the seasonal differential charging scheme at Macclesfield. To increase the sales of gas by nearly 20% in a period of five years is no mean attainment in these competitive days, and it goes to prove that the flat rate system of charging for gas is obsolete. It must not be overlooked, however, that in Macclesfield the average price received for gas has been reduced by nearly 20% during the past five years, or over 50% during the past ten years, and this reduction must have had a favourable effect upon the consumption, quite apart from the merits of the price policy which has been adopted. One factor that has helped to reduce the price of gas has been the reversal of a previous policy of free hiring of cookers and gas fires. Interest and sinking fund charges have also been reduced by 50%.

It is stated that the object of inaugurating the seasonal differential charging scheme was to level up the load factor, but in this respect it has not been successful to any great extent, since the increase in the summer period is 27·8% and in the winter 17·8%. In similar cases, therefore, some undertakings would have had to erect additional plant to meet the increased winter load, thus incurring additional capital charges. While the seasonal differential charging scheme has very definite limitations, there are many points which commend it, possibly the most outstanding feature being its simplicity, while the success of any tariff is dependent, to some extent, upon its appeal to consumers. If a tariff is so complicated that the consumer is unable to understand it, then it is likely to have an adverse effect upon increased consumption.

The reduction in price under the scheme from 7½d. per therm for the first 40 therms per quarter to 6d. per therm for 300 therms provides, to some extent, a service charge, but is a seasonal charge sufficient to meet present-day competition, particularly in connection with the industrial load. It would appear that a seasonal charge has a far greater beneficial effect upon the domestic consumer, whose demand is elastic, than upon the industrial consumer, and this deduction is supported by the data given in Table VI., which shows that over the last five years the power load at Macclesfield has increased by only 2¼%, as against a general increase of nearly 25% over the same period.

No Ideal Method.

It must be admitted that there is no one ideal method of charging for gas that will meet the requirements of every undertaking with their varying circumstances, and each undertaking must face its own problem. One factor, however, that is common to most undertakings is the reduction in consumption during the summer months. Certain plant has to be provided to meet the maximum demand during the winter period, and after making due allowance for repairs, &c., during the summer months, plant is standing idle which could be usefully employed to the benefit of both the consumer and the undertaking, even if the gas made during this period has to be sold at little over the prime cost of production.

Does the seasonal differential charging scheme meet the case? The author of the paper states that "though there was a gratifying increase in the summer demand, this increase persisted during the winter, and the levelling up of the load factor was not realized to any great extent." The continuation of the increased consumption of gas through the winter is attributed to the increased standard of comfort obtained by the use of gas fires, water heaters, &c., which the consumer will not forgo having once appreciated their value. From this experience it would therefore appear that most undertakings will have to exploit the possibilities of increasing the industrial consumption to level up the load.

It must not be overlooked, however, that there is a marked tendency, at least in some undertakings, for the summer load to increase without the aid of any artificial stimulant in the form of a discount of 50% as shown in the example (p. 794).

The explanation of the levelling up of the load as illustrated by the foregoing is due to the fact that the lighting load is being lost and is being replaced by other loads which do not make such a large demand in winter. The time, therefore, is approaching when the summer load, *plus* plant off for repairs, will be equal to the winter load, and, consequently, the seasonal factor is less and less important in considering gas charges.

The main criticism of the seasonal differential charging scheme is that it is too elementary for many of the larger undertakings. It does not go far enough. The main justification for the scheme adopted at Macclesfield is to increase the demand in summer, but, as previously pointed out, this object has been achieved only to a limited extent. The

—	Million C.Ft.	Per Cent. of Total.
1	2	3
1909—		
April-September	2,084	37 summer
October-March	3.553	63 winter
Total	5,637	100
1923—		
April-September	2,613	39 summer
October-March	4,019	61 winter
Total	6,632	100
1933—		
April-September	3,060	42 summer
October-March	4,250	58 winter
Total	7,310	100

seasonal demand, however, is only a very minor factor in fixing a differential price, the following being the main considerations:

1. *The Standing Charges Necessary to Provide a Supply of Gas.*—Every consumer who has the convenience of demanding a supply of gas at a moment's notice has a right to pay an economic charge for that privilege. This charge should be assessed on the potential demand of each particular consumer, and can be fixed by—

(*a*) The size of the meters or service pipe.
(*b*) The consuming appliances installed.
(*c*) An average of previous consumptions.
(*d*) Rateable value of premises.

2. *Consumers' Costs.*—This charge would only refer to a limited class of consumers, and would be imposed where some special expenditure is necessary—*e.g.*, the necessity for laying a special main, or where there is a large consumption for a short period.

3. *The Commodity Charge.*—This would be a unit charge based on all charges incurred in the manufacture and distribution of gas, other than those outlined above. It could, and should, be further sub-divided to suit local conditions—*e.g.*:

(*a*) A reduced price for gas consumed in the summer time.
(*b*) An industrial tariff to encourage industrial loads.
(*c*) A tariff to encourage heating loads, &c.

The foregoing is an example of what is generally referred to as a two-part tariff.

The author objects to two-part tariffs on the following grounds:

1. The "fixed charge" (see No. 1 above) is made at a regular rate irrespective of the quantity of gas consumed during the period.

If, however, there were any serious objections to a regular periodical rate, the charge could be so adjusted as to be proportionate to the quantity of gas consumed. Since rent, rates, and taxes are demanded at regular periods there is hardly likely to be much serious objection.

2. The "fixed charge" (see No. 1 above) is an arbitrary one which it is never possible to establish to the satisfaction of all consumers.

If a definite principle is adopted—*e.g.*, a charge based on the size of the meter or service pipe—then it should be possible reasonably to satisfy all consumers that it is an equitable charge.

3. The system is not easily understood by the consumers.

If principles are clearly laid down, and there are not too many exceptions and deviations from them, then there is no reason why consumers should not be educated to the reasonableness of a two-part tariff.

It is stated in the paper that public utility undertakings are expected to "carry" a certain proportion of unremunerative consumers. Surely it is unnecessary for any undertaking to spend capital in providing a supply of gas in order that a consumer may boil water occasionally on a gas ring. If service is required, the expense of providing it should be borne by the individual consumer and not by a general body of consumers. Uneconomic business is of no use to any undertaking, and the provision of a two-part tariff assists to eliminate it.

In conclusion, it is obvious from the data given in the paper that the seasonal differential charge has undoubtedly assisted the undertaking in increasing the demand for gas, and Mr. Curtis is to be congratulated on his initiative in dealing with a difficult problem. The scheme adopted, however, can hardly be said to be scientific, and its success at Macclesfield has possibly been influenced by:

(*a*) The fact that the price of gas has been reduced by 20%, and
(*b*) That the industrial load amounts only to 7% of the total sales.

Mr. Curtis: I should like to take the opportunity of thanking those members who have paid me the compliment of taking part in the discussion and also for the complimentary references that have been made to the paper. In presenting the paper I recognize the very controversial nature of the subject, and from the nature of the points raised in the discussion it is obvious that it is a subject which necessitates the serious attention of the Industry. The difficulties of devising any scheme for general adoption are very considerable, and I am of the opinion that each undertaking will have to adapt itself to its own particular circumstances. With these concluding remarks I shall be only too pleased to avail myself of the opportunity of replying in detail through the Press to the various points that have been raised.

The Institution Benevolent Fund

The General Meeting of the contributors to the Benevolent Fund of the Institution of Gas Engineers was held at the Park Lane Hotel, Piccadilly, W. 1, on Thursday, June 7, 1934—Mr. F. P. Tarratt (the President of the Institution) in the Chair.

The Hon. Secretary (Mr. J. R. W. Alexander) read the notice convening the meeting.

The President said: I have read the minutes of the General Meeting, held in Liverpool on May 31, 1933, and they appear to be a correct record. Is it your wish that they should be read or shall I sign them as correct?

It was agreed that the minutes be taken as read, and these were duly signed.

The President: I now have to move: "That the Report of the Committee of Management of the Benevolent Fund of the Institution of Gas Engineers for the year 1933-34, and Accounts for the year 1933, which have been printed and circulated to contributors, be taken as read and adopted." You will remember that in my Presidential Address I referred to the paucity of subscriptions to this fund, and I should like again to express the hope that we shall get a large increase in subscriptions. It is not the amount that each individual member gives, but if every member of the Institution would associate himself with the fund, we should soon obtain a very much more satisfactory result. Anything above 5s. is very acceptable, and it will be very gratifying to know that we have a larger percentage of subscribers. If you all knew of the worry that this Benevolent Fund gives to the Committee, I am sure you would come forward to help. We have just sufficient money to dole out every year to the recipients, and, although we do not want to add to the number of recipients, we would like to add slightly to the amount that we can give to them.

The Report and Accounts were then unanimously adopted.

The Hon. Secretary then announced the election to the Committee of Management for three years of Messrs. S. E. Halliwell (Bristol) and D. M. Henshaw (Huddersfield).

Mr. Octavius Thomas (Rhondda): I have much pleasure in proposing a hearty vote of thanks to the Chairman of the Committee of Management and the Hon. Secretary of the Benevolent Fund for their excellent services during the past year. You have heard that the Committee has been unable to do as much as it would wish owing to lack of funds, and I appeal to those members, who do not subscribe to the Fund, to do so. I think really that every member should be able to subscribe 5s., if not more, and, if we cannot obtain the money in that way it seems to me to be a question as to whether it would not be more advisable to increase the general subscription of members to the Institution to include an amount for the Benevolent Fund. We have had very many bad cases, and I do appeal to those, who do not subscribe at the present time, to support the Fund. I have much pleasure in proposing this vote of thanks.

Mr. E. F. Keable (Gorleston): I have very great pleasure in seconding the vote of thanks and at the same time wish to emphasize the appeal which Mr. Octavius Thomas has just made.

The vote of thanks was carried with hearty acclamation.

Modernizing Small Gas Undertakings

By D. B. PARKINSON, M.A.,

Engineer at Chief Office, The British Gas Light Company, Ltd.

The PRESIDENT: I am sure we are all very much indebted to Mr. Parkinson for the excellent paper which he has put before us. It deals with a side which has not been dealt with for quite a long time, and as the majority of the members are concerned with medium and smaller works it is a paper that should attract their attention.

Col. W. M. CARR (Stretford): The value of this communication so far as I am concerned has amply repaid the amount of study that I have been able to give it up till now and the considerable amount of further study that I intend to give it after the meeting. The line of thought that is developed throughout is the necessity for the application of the most suitable plant for a particular district, and the paper shows how impossible it is for anybody to dogmatize as to what system of carbonizing plant may or may not be the best. On that point alone the paper is of enormous value. I would like to express my appreciation of the most estimable way and the detail in which the work has been carried out, the results of which are shown throughout the paper.

There are one or two points which particularly attracted my interest, and one is the use of the Congdon standpipe in small works. As I was interested and, indeed, responsible for the first installation of Congdons on these lines in this country, I am naturally interested in what has been done in these small works. The author states that he is circulating directly from the yard tank, which is about 15,000 gallons capacity, and that, provided the condensates from the condenser seal pot were run into the return pipe from the Congdon system so as to make up the loss of liquor from evaporation, no difficulty was experienced until the temperature of the liquor in the sealed pots at the base of the Congdon was as high as 182° F. Perhaps I am not quite correct in saying that, because the paper does not give that figure, but it is the figure I should anticipate it might be. I would anticipate the figure might be as high as that, but when it reaches the well I should anticipate that the temperature of the liquor might be 120° to 140° F.; and it is surprising to me that it has been practicable to work such a scheme without very considerable nuisance, because the release of ammonia in the well, I should think, would be excessive. I myself tried circulating over the Congdons from our storage well for two days, and in those two days we raised the temperature of the well from 64° to 90° F. and then had to stop for the reason I have indicated —*i.e.*, nuisance.

One other point I should like to refer to is coal gas dilution by taking the producer gas from the producers heating the settings. That system I think is practised on a fairly extensive scale, and Mr. Parkinson gives the analysis of the mixed gas in his paper. This is rather surprising to me, because of the relatively low hydrogen content of 33%, while I am also surprised to see the nitrogen content as high as 22·8%. A typical analysis of a crude mixed gas made at Stretford, which, of course, is a much larger works, and using producer gas from the settings, gives the following figures:

CO_2	3·3
O_2	0·4
C_nH_m	2·8
CO	8·4
CH_4	25·7
H_2	50·7
N_2	8·7
Density	0·4·6
Calorific value	508·3

I should be interested if Mr. Parkinson would say why the hydrogen content was so low and the nitrogen content, in my opinion, rather too high.

DAY OF "SPLENDID ISOLATION" PASSED.

Mr. E. F. KEABLE (Gorleston): Mr. Parkinson's communication comes to us at a time when the matter contained therein is of vital importance to our Industry, and I am certain it will be carefully re-read far beyond the confines of this building.

As the Engineer of one of the Undertakings referred to in the paper, I am naturally very interested in its contents. I am sure that the day of "splendid isolation" should long since have passed; the keen competition we are facing demands co-operation all along the line. In the interest of our great Industry, all selfish and parochial points of view must surely give place to the new outlook. We have a commodity to offer second to none, and if made and distributed by efficient plant to the consumers, it will not only hold its own, but continue to expand in usefulness to the domestic and commercial community.

Under the heading "Introduction," the author rightly states that it is lack of capital rather than lack of desire which keeps new and efficient plant from being installed, and further that an early return upon capital if expended is essential to a small undertaking. It is in this connection that those of us who have been privileged to have behind us the financial backing of the British Gas Light Company realize what immense value such help is. Our new installation of Woodall-Duckham continuous vertical retorts, with coal discharging plant from steamship to store, and coke grading plant is not referred to in the paper, as this was carried out prior to Mr. Parkinson's present appointment, but reference is made to our distribution boosting system. During the years of the war, my old Board of Directors had to face an increase in the demand for gas amounting to 54% in four years, and they accepted my scheme of running a 5 in. welded steel feeder main with branches, and district reducing governors to support the heaviest points in demand on our low-pressure trunk mains. The district is nearly five miles in length and is referred to by Mr. Parkinson as being in the form of a dumbbell, the greatest points of consumption being at its extreme ends. At one end we have one factory alone which last year took from us 7 million c.ft. of gas, and this had to be supplied at a constant pressure of 5 in. Only those in charge of such undertakings at seaside resorts realize what the peak loads mean. Since the British Gas Light Company acquired the controlling interest, this system has been added to, and last year we installed a steam-driven vertical enclosed duplex tandem reciprocating compressor of 60,000 c.ft. per hour capacity. We can now offer to our consumers gas of even quality and adequate pressure—in our opinion the two essentials to steady progress.

There is one important fact which links with this last statement—namely, that while engaged in writing down some of the capital expenditure involved on both works and district, we have found that, given good service, the consumers have been remarkably patient with reference to the price of gas, last year our sales of gas increased by nearly 3%.

There is much in the paper of both special and general interest, to which one could refer, but I do not purpose taking up any further time, except to say that it is of interest to see the return of the use of inclined retorts at the Baldock undertaking, for it goes to show that each case is looked at and dealt with as best suits the local conditions.

PROBLEMS OVERCOME.

Mr. J. S. THORMAN (Gas Light and Coke Company): I wish to add my thanks to Mr. Parkinson for the very interesting paper which he has presented, giving in such detail the problems which his Company, the British Gas Light Company, have had to face and which they have so efficiently, economically, and ingeniously overcome. Quite a number of costs of certain reconstructions are given which will be an exceedingly valuable reference to all interested in the smaller undertakings. I would refer to the reconstruction of the King's Lynn carbonizing plant, resulting in a saving of 3d. per 1,000 c.ft. of gas made, as an impressive success.

I am interested in the introduction of the Congdon system of standpipes at King's Lynn and should be glad to know if the improvement in carbonizing results recorded was due largely to this system; and while on this subject I should like to know whether any form of anti-dip for working unsealed had been tried, as it is obviously a cheaper proposition to work unsealed with old hydraulic mains, than to reconstruct them. Reference was made to the successful working unsealed, at Fenny Stratford, without I think any form of anti-dip, but dependent on a very sensitive retort-house governor. This method appears to be a very cheap and simple method of curing the trouble of distorted hydraulic mains. I should be glad to know whether any difficulty had been experienced with pressure during charging, or whether the vacuum had to be increased at the retort house governor before opening the retorts for discharging and charging. Mr. Parkinson's experience at Fenny Stratford of diluting coal gas with producer gas is particularly interesting, and perhaps Mr. Parkinson could amplify his information by telling the members the amount of coal gas per ton (and calorific value), the amount of producer gas added (and calorific value), and the resultant calorific value. It would also be particularly interesting to know the fuel consumed in the producer in the manufacture

of producer gas used for dilution, and the extra therms produced from it.

A Departure from Recognized Methods.

Mr. R. J. Restall (Stalybridge): The modernizing of several small undertakings is bound to provide a wide field of investigation, and, consequently, it is possible, perhaps, to depart from what may be considered recognized methods of procedure for, and consideration of, certain sizes of works. The precaution suggested by the author in the summary, to link up undertakings before commencing alteration, might indicate the incapacity of the undertaking to be altered to supply sufficient gas; the question arises: Why alter these undertakings?

The paper is most opportune and offers scope for thought from the point of view, not only of reconstruction of the undertaking but of area policy. In the author's introduction, mention is made of available salesmen. I wish to express the opinion that unless salesmen are continuously on the spot, even in a small district, their efforts do not suffice to cope with the needs of to-day. Mr. Parkinson draws attention to the capital cost of plant on a small works. The position of a small works becomes so difficult that money spent may well mean a great sacrifice in other and needy requirements which are put off. In such a case the corporations referred to are able to provide the capital. By building and designing smaller units, much may be done towards reconstruction, and although it cannot be said all, it may be said that most systems and plant are capable of being usefully employed on smaller works. The chief barriers to this are lack of capital and enterprise.

The fact that horizontal retorts with hydraulic mains, horizontal retorts with Congdon scrubber stand pipes and charging machine, inclined retorts, and also intermittent vertical chambers, are suitable for works of varying small sizes, is in itself a very valuable fact, particularly with regard to the installation of intermittent vertical chambers. The charge in this case is static and fairly large—viz., 2·3 tons—and it is, therefore, shown by this fact that there can be little or no trouble experienced in manufacturing a gas of constant calorific value; such a plant I believe is capable of great flexibility, and I should be glad if the author would tell us the difference in load in summer and in winter at Westgate. I have had the privilege of seeing this plant, and it is a very attractive job and admirably suited for a works of such size. The plant is clean and easy of operation and gives the impression of very low labour costs. From the number of plants of this type working on the Continent it is known that they have been successfully worked for many years.

With reference to Baldock I believe that the figures obtained for coke available for sale may be considered as fairly satisfactory in view of the size of the works. It would be interesting to know the author's opinion as to the possibility of using Congdon scrubber stand pipes on this installation; plant erection commenced in 1930, and several well equipped Congdon installations had been going then for a number of years.

In regard to King's Lynn, the plant was reconstructed in 1931-32, the number of consumers was 5,563, and the coke sold per annum will be approximately 4,400 tons. I should be glad if the author would say whether in this instance coke cutting and screening machinery was installed, as there is no definite mention of plant installation. If there is no coke screening plant on this works I should be glad to know why a coke cutting and screening plant was put in at the Westgate works, having a slightly smaller output than King's Lynn, and at Storrington (5 million c.ft. per annum). King's Lynn is the largest works described and serves a fairly important market town. Further, the author states that coke grading, provided it is backed by an improved product, will create a demand for itself. With this remark I agree, and, from our experience during the winter 1933-34, it is interesting to note that our graded coke sales have increased 6 times compared with the winter 1932-33. The comparative tonnages are 1932-33, October to March, 147 tons; 1933-34, October to March, 871 tons. The coke produced is of low ash content and has been served as free from dust as possible and in a dry condition. It appears that the policy on the various districts will give much benefit to individual consumers, particularly with regard to the inclusion of ¾ in. governors at the inlets of consumers' meters; it would appear almost worth while for meter manufacturers to consider the inclusion of governors on their meters.

It may not be a fair comparison, but nevertheless it is interesting to note the saving on the cost of the gas into the holder on a reconstruction at Westgate is twice the saving at King's Lynn. Perhaps the author would kindly indicate the reason.

With regard to the general observations I would like to make, the following seem to me important as far as small works go: That the plant must be as trouble free as possible, and that as much machinery as possible should be eliminated and where possible simple hand-operated apparatus should be used; the maintenance on such is generally very low. On small works, particularly of the 100 million c.ft. per annum size, I do think it is necessary to attach importance to plant contractors' guarantees. The plant and machines put in should definitely be capable of dealing with the quantities stated; if they fail, it becomes a serious matter, particularly with regard to coal throughput, and, consequently, the quantity of gas manufactured per diem.

Horizontal retorts on small works have the advantage of being capable of hand stoking in case of machinery breakdown, this has some value where a standby plant is not installed. The problem of controlling calorific value and also gas outputs, where excessively high peak loads occur, may be effectively dealt with by the installation of a small gas producer plant (as mentioned at King's Lynn). Where the area of a works is small and lies in a densely populated district it is most important to eliminate as far as possible continuous and intermittent noises, and also nuisances from steam, smoke and dust.

The factors controlling linking up are numerous, and the point mentioned, regarding coke transport charges, needs careful thought. This I think also applies to coal transport.

The author does not say quite enough about the policy of his Company, but one gathers that preparation is being made for the future and it is hoped that their present and their new policy will be for the material good of the Gas Industry.

"Up Against It."

Mr. W. Clark Jackson (Neath): I have had some little experience with small works during the past few years, and it has struck me that they are really up against it, so to speak, in these days of keen electrical competition. In the old days they were in the rural districts and had more or less a monopoly of the lighting and heating business, but to-day that has changed very considerably. Electricity has gone into these rural districts with very low rates, and the small gas undertaking is now faced with extraordinarily keen competition. Unfortunately, most of these small undertakings are not as efficient as they might be, and from my own fairly intimate knowledge of a number of them I have long ago come to the conclusion that the only salvation for a number of them is to be taken into a group such as the British Gas Light Company, where the advantages of group management of control and engineering are such as have been put before us this morning in this paper in the illustrations of the extensions and alterations which have been made at the various small works described.

With regard to extensions and alterations, I do not propose to make many comments, but I suggest that there is room in small undertakings with outputs of from 25 to 40 million c.ft. for waste-heat boilers. I myself happen to be interested in a small gas company turning out 30 million c.ft. and all the steam on the works is generated from a waste-heat boiler. The retort installation consists of three settings of horizontal single-end retorts, and no difficulty has been experienced at all in obtaining all the steam required. The author has not brought out in his paper the question of verticals in small works. I believe there is an opening for these, and I think it has been proved in a very large number of cases during the past ten years that even from an economic point of view verticals on works of 30 million c.ft. and upwards can at times, anyhow, be put down with very considerable savings to the gas undertaking. Furthermore, there is the automatic blue water gas plant, recently put on the market, which has attractions, and which I am myself looking into in connection with some other small works. There is, however, another feature altogether apart from the purely engineering side—namely, the service side of small undertakings, which I believe is one of the weakest links in the whole chain. Many small undertakings have neither the facilities nor the staff available to give such service as is absolutely essential in these days for any undertaking to withstand competition. Here again I believe that by judicious grouping it will be possible to maintain a service staff which could be moved from one works to another and so right round the whole group, starting at the first again, enabling service to the consumers to be maintained and, consequently, the efficiency of the undertaking, as a part of the whole Industry at a higher level.

Mr. H. J. Toogood: I should like to refer to fig. VI. If you take that as a typical horizontal retort bench—never mind whose manufacture it is—one of the last pieces of work that I did when in harness was to prove conclusively that the main arch was unnecessary and that it was handed down from prehistoric times. Similarly, much of the brickwork in horizontal retort settings can be deleted, which will reduce the thermal capacity of these settings and add to the economies of small works. This type of savings,

indeed, can be extended. The author shows a Congdon pipe, and it was my privilege to prove that the ascension pipe on several of the hydraulic mains could bring the gas out-take of the pipe to ground level where it could be better looked after.

Further Economies.

As regards further economies which can be made in small settings I should like to touch on the producer arch. That is constructed of silica, which costs a lot of money and has ports in it which allows the producer gas to pass up into the settings. The function of that producer arch years ago was to prevent the dust-laden flame from the fire impinging on the fireclay retorts; but refractories have very much improved, and there is no need for that producer arch now. It might as well be done away with and save quite a lot of money, which is what we desire to do, and at the same time increase the efficiency of these small works. Therefore, I conclude that part of my remarks by saying that everything should be done to cheapen the cost of plant in small gas-works.

I associate myself with the last speaker in his advocacy of the application of waste-heat boilers. I think there is economy to be brought about there, particularly if you will delete the chimneys, because there is no need for chimneys in gas-works at all. There is no smoke to carry away; you simply require your waste-heat boiler, and if you put them down in duplicate there is no need to have chimneys. Reference is made in the paper to coal gas dilution by producer gas, but I should like to look upon producer gas dilution as a palliative. Surely the day has come when we should make water gas with horizontal retorts. Mr. Madden, of Cardiff, recently drew attention to the interest in this matter. Personally, I was interested in it in 1914, and I should like to mention one experience which I had. We drilled a hole in the mouthpiece lens of a through horizontal retort and passed steam into one end and turned on a good size flame of water gas for 24 hours through the other orifice. This proved to us that where we had plenty of water gas available we only needed to control our steam. As a result we put in many plants which operated quite successfully for a period, but after the war they gradually fell into disuse. I would suggest, however, that experiments should be carried out on steaming horizontal retorts. I think the arrangement has not been tried of admitting steam into the centre of the length of the through retort and laying steam pipes both ways, thereby keeping the layer of equal thickness over the length of the retort and enabling you to carry on steaming with success.

Directors' Responsibility.

Mr. A. A. Lucas (Newhaven): I should like to express my appreciation of this paper which will be very useful to the managers and engineers of the smaller undertakings. Considerable reference has been made to the fact that smaller undertakings lack capital and enterprise, and I think that is largely due to the fact that the directors of small undertakings do not realize their responsibilities sufficiently. If the engineer was given a little more scope and more assistance by his directors a good deal could be done even without the assistance of such concerns as the British Gas Light Company. In my case we have during the last five years spent no less than £25,000 in development, of which, roughly, £13,000 has been spent on distribution, and we have just finished a works reconstruction scheme costing £10,000 which includes a Glover-West installation of four 33-in. retorts, a new exhauster house, and the transference of part of our plant from leasehold ground to a freehold site. I mention this to show that enterprise is not lacking in all the smaller undertakings, and I repeat that if the directors would only give their support to their engineers a great deal could be done for the benefit of the Industry generally.

It has taken me sixteen years to bring our works up to the point we have now reached. When I first went to Newhaven in 1918 we simply possessed hand-charged retorts to which I added, in a short time, a small producer which we have built ourselves at a cost of £80 as a dilution plant. In 1923 we added two regenerator settings, and in 1928 we installed a 200,000 c.ft. per day water gas plant with a new Cornish boiler at a cost of £3,000, of which £2,000 was provided out of revenue. In 1932 we were faced with the problem that we were modernizing our existing plant on leasehold ground and we went over to freehold land and put in a completely new installation. We are now just at the point of completing that work, and therefore I cannot give any figures of working results because the new plant has not been operating for a sufficiently long time. We have only been working for six months, but I think I can safely say without any boasting that we now possess a really up-to-date works for its size, and I might also add that our capital cost does not work out to more than £1,000 per million. I should also like to express my appreciation of the assistance I have received from our contractors and to emphasize that all the contractors are always willing to assist the small undertaking by allowing a certain length of time to pay for any works that may be undertaken. That is a great assistance to the small undertaking and I should like to express appreciation of it.

When we were considering our new works we took the opportunity of investigating very thoroughly whether we should install horizontals, machine-charged intermittent verticals, or continuous verticals, and we eventually made our choice of verticals, mainly from the point of view of capital cost, although horizontals presented many advantages in other directions. We have, however, every reason to be satisfied. Incidentally, I would like to offer my congratulations to Mr. Parkinson on the Westgate plant. I had an opportunity of seeing that, and there is no doubt that it is certainly a nice little plant. I should also like to refer, if the Engineer, Mr. Parsons, will permit me, to the plant that has been installed at Leominster, Hereford. That plant was by Jenkins and consists of 15 ft. horizontal machine-charged retorts operated by one man only. It was a very attractive little proposition, and we were forced back again on to the question of capital cost in the first place. I may add that it is also possible to work our plant at Newhaven by one man only.

Mr. Parkinson: I should like to thank you very much for the way you have received this paper and for the very kind remarks you have made about it. When I first wrote the introduction saying that I should have considerable diffidence in presenting the paper, the Secretary made me take out the word "diffidence." He said there was no diffidence in the Gas Industry, but nevertheless I did feel considerable diffidence. I shall not have time to reply now to all the questions that have been raised, but will do so in writing. There are, however, two points I should like to refer to. Mr. Restall referred to the coke grading plant at King's Lynn. There is a coke grading and screening plant there, but it was not put in for some considerable time, about six months, after the other plant was completed, and that is why I did not mention it. In fig. V., however, you can see one corner of the coke hoppers of that plant.

The other point was raised by Mr. Clark Jackson with regard to continuous verticals. I have pointed out in the paper the work that has been done by contractors in supplying continuous verticals for small works, but I did not go into the matter in detail because I do not happen to have been associated with the building of them, but I realize that they are a very important plant for small works.

Social Events and Visits

Reception and Dance.

This was held on Tuesday evening in the Ballroom of the Park Lane Hotel, where it seemed that far more than the officially recorded 800 assembled to honour the excellent arrangements; and dancing commenced long before the President and Mrs. Tarratt had completed the strenuous but cheerful task of welcoming each individual guest. Mrs. Tarratt at the reception carried an exquisite bouquet of dark pink carnations, presented to her by Mr. R. H. Duxbury on behalf of the North of England Gas Managers' Association, of which Mr. Duxbury (Engineer, Manager, and Secretary of the South Bank and Normanby Gas Light and Coke Company, Ltd.) is President.

Jack Palmer and his Band were unflagging in the provision of music both for dancing and for an excellent cabaret; indeed, the only break they had was when Mr. Tarratt presented the prizes won at a Golf Meeting on Monday.

S.B.G.I. Golf Circle.

This was the Spring Meeting of the Society of British Gas Industries, which was held at Sudbrooke Park, Richmond, and to which visitors were cordially invited. The "Thornton Victory Cup" was competed for over 18 Holes Medal, and was won by Mr. E. J. Davison with a score of 88 − 17 = 71. The Frank P. Tarratt Prize for visitors, an inscribed silver salver, was won by Mr. W. Clark Jackson with 76 − 4 = 72; and in the afternoon foursomes against bogey, for two prizes presented by a Member of the Circle, Mr. C. H. Kempton and Mr. F. Brian Holmes, with 2 up, secured each a handsome inscribed entrée dish.

MRS. FRANK P. TARRATT.

An American Reunion Dinner.

The phrase "Nothing could have been better" was voiced frequently last autumn among those who were privileged to take part in the Institution visit to Canada and the United States of America, and it was reiterated on Wednesday evening, when an American Reunion Dinner took place in the Tudor Room of the Park Lane Hotel. The function was, indeed, a delightful sequel to a tour boldly conceived, admirably organized, and carried through with outstanding success, under the leadership of a President and his wife who were "made for the job." Gratitude had been felt, and thanks had been expressed, to all who had had any responsibility in the matter; and then, when all seemed to be over, the Keeper of the Purse produced yet another "rabbit" from the "hat," in the shape of good fare which, joined with good company, was enjoyed by a party of nearly seventy, comprising delegates and their ladies, a number of whom had been on the trip. There were inevitably a few who were unable to be present, but they were in our thoughts during the evening, and particularly while drinking the toast to "Absent Members." Mr. Fritz Escher telegraphed his deep regret at inability to be present, and sent his best wishes. Doubtless many of those at the dinner are looking forward to meeting Mr. Escher once again in September, when he will preside over the Second International Gas Conference to take place in Zurich.

But important as was the toasting of absent members, there were, of course, others which preceded it. After the toast of "The King" had been honoured, Mr. Tarratt went on to submit from the Chair "The President of the United States of America" and "Our Friends of the American and Canadian Gas Associations." Greetings had been cabled to these Associations, and by pre-arrangement the last-named toast was drunk at 9.30 precisely, so that a corresponding toast to the Institution might be proposed simultaneously in New York and Toronto. Mr. G. W. Allen had cabled greetings on behalf of the Canadian Gas Association, and a promise to contribute to the Sir Arthur Duckham Memorial Fund, while Mr. Arthur Hewitt had also expressed his cordial appreciation of the many warm friendships made by him during the Institution tour.

Colonel Carr well expressed the thoughts of all when, in proposing "Our Chairman," he declared that "no delegation ever sailed from the shores of England under a better commanding officer. The success of the tour, and the fact that all went away friends and came back better friends, were due to the ability of Mr. Tarratt and his tact in the handling of the large party. Mr. Tarratt made a wonderful and lasting impression on the Gas Industry of Canada and the United States." In his response, the Chairman said that no leader of a delegation had ever had so good a team. During his Presidency he had had the fullest possible support of the whole Industry. No man could have worked harder for the success of the trip than Mr. Alexander, whose organizing was excellent. Mr. Tarratt acknowledged his indebtedness to his wife for her loyal and unflagging support throughout the trip, and Mrs. Tarratt graciously and gracefully made acknowledgment of the many kind things which had been said.

Proposing the health of "The Secretary, without whom the visit would have been impossible," the Chairman stated that the Institution had never been better served than it was to-day. ["Hear, hear."] He had the very greatest admiration for Mr. Alexander and the ability which he brought to bear upon his work. Replying, Mr. Alexander pointed out that two things were necessary to the success of any organization. One was co-operation and the other was an able President, and both of these he had.

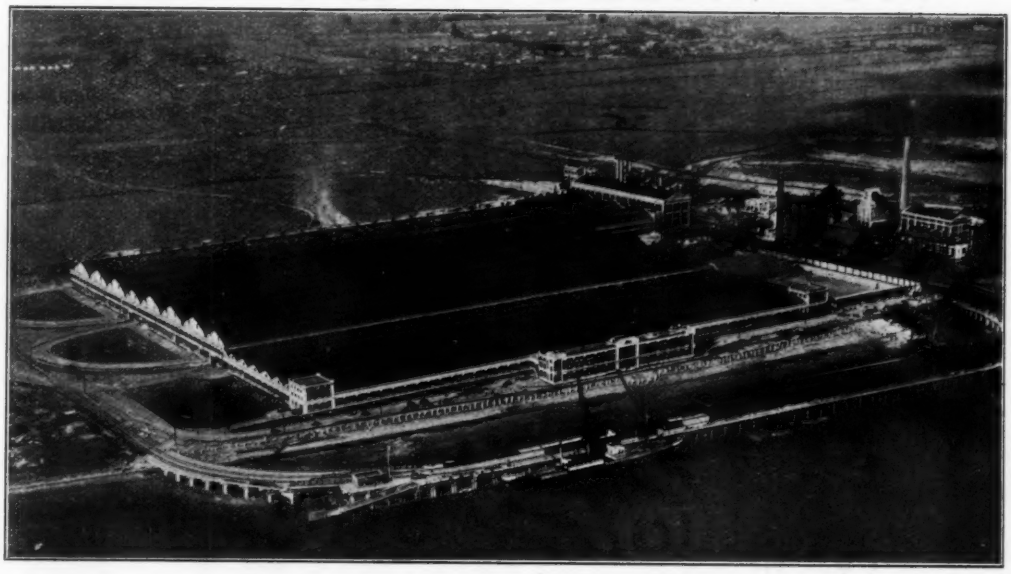
Evening Star Lodge, No. 1719.

On Monday, June 4, the Evening Star Lodge held its Regular Meeting, which had been postponed from the fourth Wednesday in May in order that the Lodge might be able to entertain Masonic members of the Institution of Gas Engineers who were in London for the Annual Meeting.

The Worshipful Master (W.Bro. W. F. Broadberry) was in the Chair, and, with the able assistance of W.Bro. W. H. Warren, I.P.M., Bro. G. D. Bidwell, S.W., W.Bro. W. A. Scott, L.R., J.W., W.Bro. A. B. Potterton, P.M., Chaplain, W.Bro. T. F. C. Potterton, P.M., D.C., W.Bro. A. H. Henry, P.M., Acting Assistant D.C., Bro. S. Hay, S.D., Bro. E. P. Stevenson, J.D., and Bro. H. J. Randall, I.G., passed Bro. L. C. H. Athill and Bro. W. S. Gooch to the Second Degree. This ceremony having been completed, the Worshipful Master proceeded to initiate Mr. John Young, son of the late Bro. John Young, well remembered by members of the Industry as having been for many years Engineer of the British Gas Light Company at Hull.

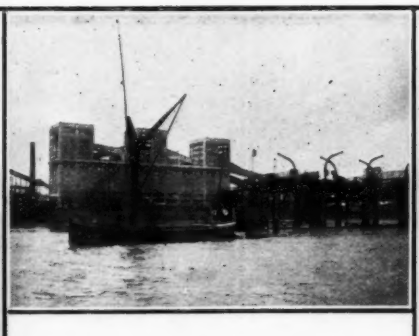
Among the many guests who honoured the Lodge by their presence were W.Bro. J. Ernest Franck, P.A.G.Supt. of Works, and W.Bro. Edgar Herring, P.A.G.D.C.; also W.Bro. E. Stamp, P.A.G.D.C., Prov. G.D.C. Warwickshire (Worshipful Master of the Murdoch Lodge), and W.Bro. H. R. Crow (Worshipful Master of the Northern Star Lodge), the last two brethren being Honorary Members of the Evening Star Lodge during their year of office. The Lodge was also signally honoured by the presence of W.Bro. Frank P. Tarratt, P.P.G.D. Durham, President of the Institution of Gas Engineers.

Where Ford Cars are Made



Six hundred acres of marshland were reclaimed by one of the greatest piling feats ever undertaken to provide for the great Ford Works at Dagenham. These works epitomize the marvels of modern car building, for at one end one may see molten metal entering the foundry in giant cauldrons, while at the other end new Ford cars are driven off the assembly line and away to their waiting buyers. A more self-contained unit is hard to imagine. A great block of coke ovens can carbonize 800 tons of coal in a day, and nearby is plant for the generation of bye-products. Seven thousand workmen are employed at these works, which possess their own hospital and school for the training of boys in every phase of manufacturing production. At the jetty, raw materials can be unloaded at the rate of 600 tons every hour, and the new cars are shipped for export. The floor of the tremendous building comprising the engineering shops is a 28-acre slab of concrete, and the roof is constructed of one million square feet of metal and six hundred thousand square feet of glass. These works leave two main impressions—one of masterly organization, and the other of amazing machines.

On Wednesday, June 6, the M.S. *New Dagenham* left Westminster Pier with an Institution party, led by the President and Mrs. Tarratt, numbering 250. Lunch was served on board, and tea on the return journey, and a most interesting tour of the Ford Works, admirably organized by the Company, was made by the party, augmented by considerable forces of landlubbers, who had made the journey by motor coach.



A blast of sirens and loco. whistles signalled our approach to the Beckton Coke Plant.

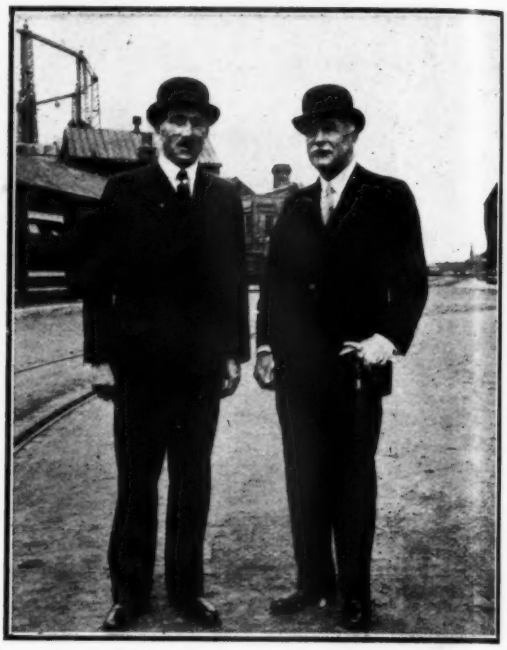
Visibility was poor on the river. But Mr. Shapley, Mr. Flavel, Mr. and Mrs. J. D. Smith—and, surely, our old friend Mr. Lamb—seem to have radiated sufficient light.

AT WILLOUGHBY LANE and

A detachment nearly 350 strong, including many ladies, left the Park Lane Hotel by motor coach on Thursday afternoon for the Willoughby Lane Works of the Tottenham and District Gas Company. Here they were welcomed by Mr. Henry Woodall (Chairman and Managing Director) and his fellow Directors—Mr. A. E. Broadberry (late Chief Engineer), Mr. W. A. Surridge, Mr. Thomas Goulden, and Mr. E. C. Woodall—by Mr. Harold C. Smith, the Chief Engineer, and Mr. E. J. K. Fussell, the Secretary. Mr. W. Hawkyard, Works Superintendent, and Mr. R. W. J. Wilson, the Mechanical Engineer, assisted by a large number of guides, then conducted a tour of this very up-to-date works, the main link in a chain of stations—Tottenham, Ponders End, Enfield, Hertford, Hitchin, and Stevenage—which supplies some 4,000 million c.ft. of gas annually to 125,000 consumers spread over approximately 100 square miles of country.

In the inspection, particular interest centred upon the Intermittent Vertical Chamber Section, designed by the Woodall-Duckham Companies for the production of 5 million c.ft. a day. This plant was inaugurated as recently as December last by H.R.H. The Duke of York; and a full report of that function and description of the plant appeared in the "GAS JOURNAL" for Dec. 13.

Tea having been served in the canteen, the party moved on to the Gothic Works, where, in the comparatively short time available, Messrs. Glover & Main, Ltd., were able to show them an astonishingly large number of the complex and expert processes which make the modern gas meter and the artistic gas cooking and heating appliances demanded in nearly every home to-day. It was a memorable visit, of especial interest, perhaps, to the ladies of the party; and Messrs. Glover & Main showed by many



Above: Mr. Henry Woodall, Chairman and Managing Director, and Mr. Harold Smith, Chief Engineer, of the Tottenham Company.

Left: Mr. A. E. Broadberry, late Chief Engineer and now a Director, with Mr. E. J. K. Fussell, Secretary of the Company.

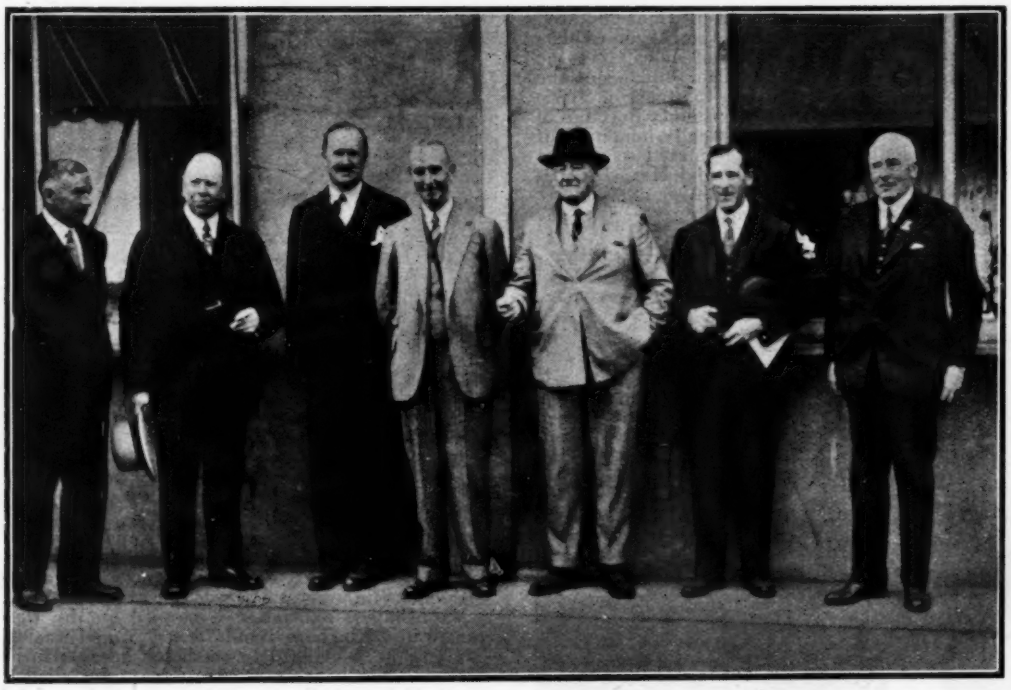
Among many well-known faces in the other photographs on these pages will be recognized Mr. Lewis Bain, President, and Mr. A. Kellock, Secretary, of the North British Association; Mr. I. G. Jenkins, President of the Wales and Monmouthshire Association; Mr. S. J. Sadler, Secretary of the Midland Association; and Mr. J. R. W. Alexander, Secretary of the Institution of Gas Engineers.

GOTHIC WORKS, EDMONTON

a token that it was, for them, too, an important event in their long history of service to the Gas Industry. One such token was the fact that the whole of their large travelling staff was mobilized at Edmonton.

Some photographs and particulars of the Gothic Works appear on other pages. Here we will only refer to the welcome extended by Mr. Kenneth Aird (the Chairman) and all his fellow Directors. This was expressed in a reception after the tour; and of many memories of many visits with the Gas Industry, we shall for long carry one of the spacious canteen at Gothic Works last Thursday—flower baskets overhead, carnations for everyone, and a bowl of magnificent sweet peas on every table.

Before the party broke up, Mr. Leonard J. Langford, of Tunbridge Wells, expressed the thanks of all to the Tottenham and District Gas Company and to Messrs. Glover & Main for the most interesting visits and warm hospitality; and Mr. Kenneth Aird, in acknowledgment, said they had been only too pleased—it was a very great honour that the Institution of Gas Engineers should have deemed them worthy of a visit.

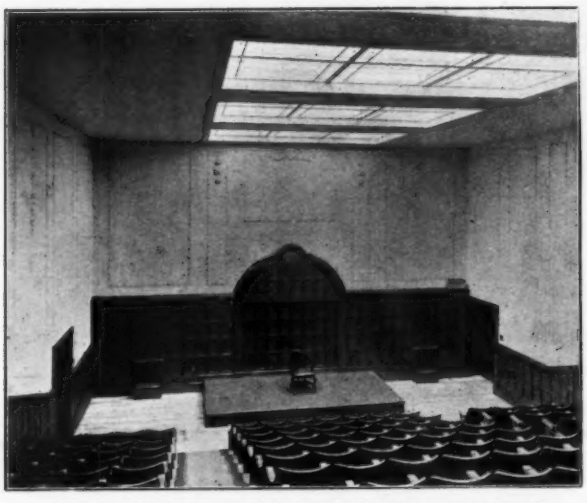


THE DIRECTORS OF GLOVER & MAIN, LTD.

Left to Right: Messrs. S. E. Wood, James A. Maclay, Colonel W. R. Glover, C.M.G., D.S.O., Mr. Kenneth Aird (Chairman), Sir Paul A. Makins, Bart. (Vice-Chairman), Major A. L. S. Wood, Sir Ernest V. Hiley.

A Sussex Tour

The outing on Friday comprised another of the Sussex Tours which have proved so enjoyable in the past. The visits in 1931 and 1932 to Brighton and Hastings are still remembered with pleasure, and this year's trip to Eastbourne was in no respect less happy. There was a large partly assembled at Victoria in the morning to join the special train to Eastbourne, all bent upon enjoying to the full the day's relaxation thus offered at the close of a busy week; and at the journey's end a blow in the bright sunshine on Beachy Head, 575 ft. in height, provided an efficient appetizer for the bounteous luncheon which followed in the Grand Hotel, Eastbourne. Here the Mayor (Alderman G. Thornton, M.A.), in his robes of office, and the Mayoress received the visitors, and after luncheon the Mayor, in felicitous terms, responded to the toast of "The Mayor, Mayoress, and Corporation of the County Borough of Eastbourne," which had been enthusiastically honoured at the call of the President. It was an animated scene, but none was in finer fettle than were Mr. and Mrs. Tarratt, who were obviously enjoying to the full the holiday to which they were so thoroughly well entitled.



Eastbourne Gas Company's Demonstration Theatre arranged for Meetings.

In the afternoon alternative programmes were offered. The first was an inspection of the works, showrooms, demonstration theatre, and cookery school of the Eastbourne Gas Company. The party taking this tour were conducted over the works by Mr. S. W. Hammond, the Resident Engineer and Works Manager. The total capacity of the horizontal retort house is about 2,400,000 c.ft. per 24 hours, and the coal is seaborne to Newhaven, whence it is conveyed by rail to the works sidings. Fiddes-Aldridge and Guest-Gibbons stoking machines are installed; and the coke is discharged into a Drake transporter, and subsequently dealt with by Cort cutters. Adjoining the retort house are three sets of Humphreys & Glasgow carburetted water gas plant, with back-run process and waste-heat boiler.

The Theatre with the Sliding Panels opened for Cookery Demonstrations.

Naphthalene extraction is carried out by washing with gas oil in a Kirkham standard centrifugal washer, and this has now been utilized to wash for benzole in conjunction with a crude benzole recovery plant installed by Messrs. W. C. Holmes & Co.

The handsome showrooms of the Company, in the main shopping thoroughfare of the town, were much admired. These showrooms and offices, which were opened about three years ago, consist of five floors including the basement,

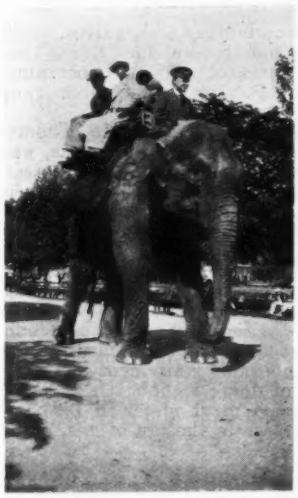
and the various features were explained to the visitors by Mr. S. E. Knowles, the General Manager and Secretary. The showrooms are replete with modern gas fittings and apparatus, and there has been added a handsome cookery demonstration theatre, which is available also for meetings and lectures. It is a delightful, airy building, in a simple but effective design, with a colour scheme in line with the rest of the building, and an excellent system of lighting. Behind the platform, screened by easily sliding panels, are a sink, a geyser, and two draining boards, which, as shown by our illustrations, are thus readily made available for cookery demonstrations.

The second part of the programme was a delightful drive to the Old Dicker Pottery, the working of which was thoroughly inspected, and to Alfriston, which is regarded as one of the most interesting villages in the South of England. The Parish Church is a beautiful cruciform structure; and the marriage register, which dates from 1504, is probably the oldest in England. On the side of the Tye (the open space in front of the church) is the fourteenth-century pre-Reformation Parsonage House. The Star Inn in the village street dates from 1520, and close by stands the famous old Market Cross. There is also a Smugglers' Inn, which provided something in the way of a mild thrill.

The two parties united again in the Grand Hotel for tea, as the guests of the Chairman and Directors of the Eastbourne Gas Company, three of whom (Messrs. Benjamin Bradford, Deputy Chairman, F. Eliot Williams, O.B.E., and Alderman G. B. Soddy, J.P.) were present.

Supper was served on the train during the return journey, and this concluded a day which had been admirably organized from start to finish.

The Ladies Visit the Zoo



Tuesday was a full day for the Institution, with business sessions both in the morning and in the afternoon; but while the members were thus busy on the affairs of the Industry, the ladies were invited by Mrs. Tarratt to enjoy a delightful afternoon in the Zoological Gardens, and a large number availed themselves of the opportunity. The invitation cards admitted not only to the gardens but also to the fascinating fresh water and sea water aquarium. In the various animal houses beauty and ugliness are extraordinarily contrasted, but nowhere is this contrast so remarkable as in the aquarium, where, side by side with "monsters of the deep," there are fish of such dazzling beauty that they might be carved from precious stones or mother of pearl.

In bright sunshine, tempered by a cool breeze, Mrs. Tarratt, with the charm of manner which endears her to all, received her guests on the Fellows' Lawn, where tea was served. It was a pleasure to see her looking so well, after a far more strenuous year than falls to the lot of most Presidents' wives.

Ninety Years' Service to the Industry

The Development of a Great Enterprise

Actually, when the Directors of Messrs. Glover & Main were invited to receive a visit from the Institution of Gas Engineers, they could have wished for magic power to advance by six months or so the great extensions which on June 6 stood only in skeleton form, but which will complete the reorganization of the twin undertakings of Thomas Glover & Co., Ltd., and R. & A. Main, Ltd., at Gothic Works, Edmonton. But no lack of organization, no overlapping of effort, appeared to the visitors to hinder an output of meters, cookers, fires, and so on, which, astonishing even to the gas believers who saw it, might well discover apostates among the ranks of the opposition fanatics who number our days.

Space will not permit taking our readers through the foundry and the many shops, but the few photographs and part of the text from a brochure which the **GAS JOURNAL** had the pleasure of producing for Messrs. Glover & Main will give some idea of the development of a great undertaking and of the conditions which exist at Edmonton.

THE GROWTH OF A GREAT INDUSTRY.

It was not many years after the time that gas was sold in containers, which customers had to attach to their own burners, that Mr. Croll and a Mr. Richards were experimenting with the idea of a dry meter—obtained, so an old story avers, from a travelling tinker whom they encountered endeavouring to make a machine, based on the bellows principle, to measure gas.

Thomas Glover.

Not until 1844, when the partners were joined by Mr. Thomas Glover, of Edinburgh, were their ideas perfected by the introduction of the now famous slide-valves. Still the path of development was not smooth, for after a time Croll and Glover had differences of opinion concerning, among other things, the correct size of the valves, and their partnership was dissolved.

Like so many good Scotsmen before and since, Thomas Glover then decided to pursue his own line of ideas, and set up in business on his own account in Suffolk Street, Clerkenwell, not far from the historical Charter House. Confidence in his product was well justified, and the dry meter business grew so rapidly that before long a large factory—calculated at that time to be sufficient for all requirements—was built in St. John Street, Clerkenwell.

From here during the course of the next half-century the firm of Thos. Glover & Co. sent out some 750,000 meters (nearly two millions have been sent out since), and only recently No. 1 of this great army was purchased back again and is now kept in honourable retirement at Gothic Works, though still capable of doing its job.

The introduction of the prepayment meter in 1893 was followed by an enormous increase in the use of gas, and a

THE TINMEN'S FIREPOTS IN THE METER ASSEMBLY SHOP CONSUME 7¼ MILLION C.FT. OF GAS A YEAR.

Here is the shop with its rows of ventilator cowls. These draw dust and vitiated air into horizontal flues behind each bench.

PART OF THE BATTERY OF GAS MUFFLES FOR ENAMEL STOVING.

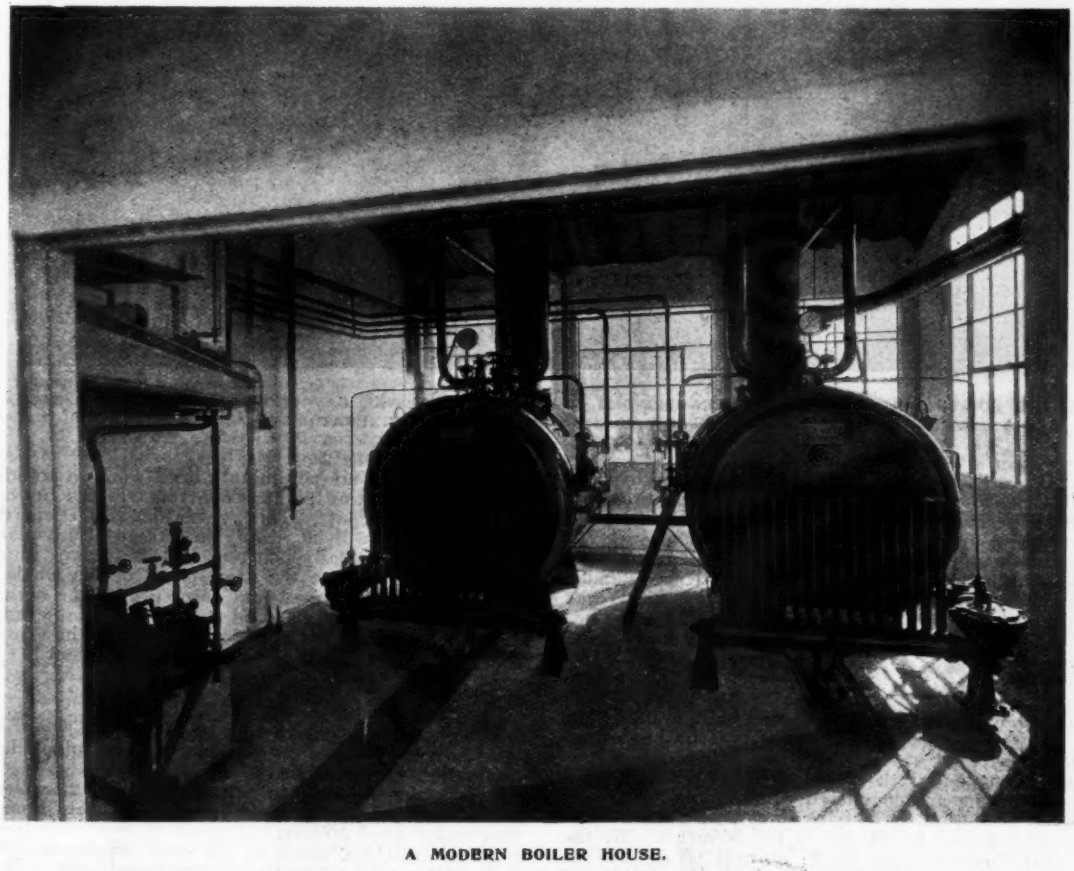
Nine muffles in use are being planned for. Consumption per muffle, 3,000 c.ft. of 500 gas per hour.

consequent increased demand for Glover dry meters; and so additional factories were taken in the neighbourhood.

R. & A. Main.

Early history relates that R. & A. Main was originally known as the Argyle Ironmongery Company, Glasgow, who were experts in all kinds of cooking and heating apparatus, and specialized in hot water and steam appliances for large institutions and restaurants. In the early 'seventies, they became interested in gas cooking, and one of their principal customers, Mr. Matthew Waddell, a Restaurateur in Glasgow, became a partner. In 1878 Mr. Waddell persuaded Mr. R. B. Main to join the business and develop it as a gas stove manufacturing concern, and changed the name to Waddell & Main.

Progress was slow until the development of electric lighting caused almost a panic in gas shares; but this new factor was largely instrumental in bringing gas undertakings generally to take an interest in the utilization of



A MODERN BOILER HOUSE.

Two Spencer-Bonecourt Gas-Fired Boilers run the Central Heating Plant, and burn, in winter, 7,000 c.ft. of gas per hour.

gas as a fuel. Then Mr. Waddell withdrew from the business, and Mr. R. B. Main was joined by his brother, Mr. A. P. Main. The name of the firm was altered to R. & A. Main, and very soon the small workshop in Waterloo Street, Glasgow, had to be vacated for large premises in Ropework Lane. Only a few years later expanding trade necessitated another removal, this time to much larger works in Park Street, Kinning Park. The year of amalgamation with Thos. Glover & Co. saw the further removal of Main's Scottish Works to the magnificent ten-acre site at Falkirk; but even this establishment was not alone able to cope with the expanding home and export trade, especially with Australia, which ensued in the following years; and in 1906 a foundry and fitting shops, &c., were added for the Stove Branch of the business at Gothic Works, Edmonton. Incidentally, it may be remarked that Main's had for many years realized the value of enamelling to the Gas Industry; and this culminated in 1927 in their pioneer production of the fully enamelled cooker.

Glover & Main.

The historic year 1897, the year of Queen Victoria's Diamond Jubilee, witnessed the amalgamation of Thos. Glover & Co. with R. & A. Main, of Glasgow; and in 1898, with output once again outstripping accommodation, the Associated Directors decided to leave Clerkenwell and build a factory on up-to-date lines.

Edmonton—now "London, N. 18," but then a village eight miles from the centre of London—was chosen, and a site of about 19 acres of ground purchased. Gothic Works were built with northern lights (then a novelty) and complete with a Canteen and Co-Operative Society for the employees.

35 YEARS OF PROGRESS.

When Gothic Works, Edmonton, was built in 1899, the ground plan was considered with an eye to the future. The original shop area was about one-fifth of what it is now, and about one-sixth of what it will be when the present extensions are completed; but ample space was allowed for expansion. Thirty-five years ago the 19-acre site seemed sufficient for all future requirements. By the end of 1934, however, the whole of that estate will be covered—with the addition of one-and-a-half acres leased from the Tottenham and District Gas Company. Actually, the extensions in course of construction are greater in area than the original works.

The original Gothic Works had an area of 91,950 sq. ft.; at present they cover 443,800 sq. ft.; and the extensions will add a further 92,740 sq. ft. When these are completed, the whole of that section of the works, as divided off by the works main road, will be devoted solely to meter manufacture, leaving the old factory, with all its extensions, available for the production of gas fires and cookers.

As an example of the attention paid to the welfare of the workpeople—at present no fewer than 1,360 hands are employed—it may be mentioned that this whole range of shops to the west of the works road is connected up with a plant for central heating and air conditioning; and the present extensions will in due course be taken in. This interesting system is worked primarily from two Spencer-Bonecourt gas-fired boilers, thermostatically controlled. The heat from these boilers is distributed into the various departments by "Unit" heaters. These units are designed to maintain a temperature of 60° F. throughout the buildings when the outside temperature is at 32°. The correct inside temperature is maintained by automatic controls. The units are capable of introducing 20,000 c.ft. of fresh filtered air per minute, and work in conjunction with the exhausting plant which removes the fumes from the tinmen's firepots. This ventilation is particularly important, for it will be readily understood that, when old meters are continually being opened for repair, fumes are given off and pollute the atmosphere of the whole shop. The complete absence of foul gases proves the high efficiency of this installation, and it is a fact that even if all doors and windows were permanently closed the ventilation of the shop would still be complete and efficient.

IN THE POWER HOUSE ARE TWO TWIN-CYLINDER HORIZONTAL NATIONAL GAS ENGINES OF 200 B.H.P. EACH, DIRECT COUPLED TO 126-KW. CROMPTON GENERATORS.

GAS IN INDUSTRY.

The photographs which we reproduce have been titled to show to what a large extent gas has been adopted in the production of essentials for the Gas Industry itself; in addition, the brochure tells us that nearly 2 million c.ft. were consumed in the brass foundry furnaces during the year ended April 30 last.

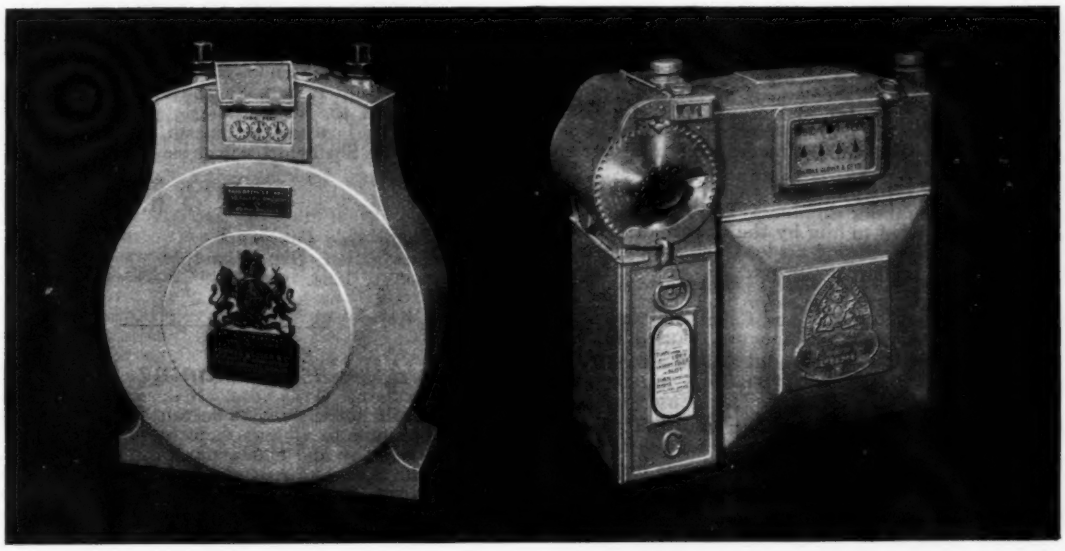
Further, in the whole of the new extensions, gas will be used for all heat-treatment processes; and it is hoped that, when rebuilding is necessary, the older muffles and

other heating plant will be converted and so form a further addition to the uses of gas industrially. This is being made possible only by the active co-operation of the Tottenham and District Gas Company. In the year ended April 30 last, no less than 67,371,500 c.ft. of gas was used, brought in from the Willoughby Lane Works of the Tottenham Company in one 12 in., one 8 in., and two 6 in. mains.

No fewer than 32 meters are at work in the various shops at Edmonton; they range in all sizes from three 12,000 ft. and three 6,000 ft. down to a single 10 lt. It will be understood, of course, that many of these are sub-meters which are essential for the correct costing of the processes in particular departments.

In conclusion, we are confident that the whole of the Industry will agree with the Directors of the joint firms, who in their brochure, state—

> It is very wonderful to recollect that these shops have grown from a tiny factory in Clerkenwell and a small iron foundry in Glasgow, and that practically the whole of them, some 14 acres in extent, together with 10 acres in Falkirk and numerous branch works, are devoted solely to the Gas Industry.



No. 1 Meter—made in 1844—still in working order, but now in retirement at Gothic Works.

Meter No. 2,634,769—1934—ready to leave Gothic Works. Where will it be in ninety years' time?

Corporation Undertakings' Results

Bangor.

For the year ended March 31 last there was a net loss of £1,047 on the Bangor Corporation gas-works compared with a net loss of £159 for the previous year. There was an increase in the quantity of gas sold amounting to 2,657,500 c.ft., and the revenue from gas sold was higher by £430. There was an increase in capital charges of £853 due to higher payments to the sinking fund and to an increase in income-tax.

Bolton.

For the year ended March 31, 1934, the Bolton Corporation Gas Department showed a gross profit of £57,369. Of this amount, £8,811 has been allocated as revenue contribution to capital account and £23,673 has been expended on renewals. The income this year from gas is down by £3,504 from last year's figures. The residuals market has also been poor and the income from residuals is down by £2,069. The amount of coal carbonized during the year was 69,541 tons, and the gas made totalled 1,265,079,000 c.ft. The gas made per ton of coal carbonized was 18,191 c.ft. The distribution department has again completed a very successful year. Cookery lectures and demonstrations of domestic apparatus have attracted good audiences and the showrooms continue to prove their value in the number of inquiries received about apparatus. There was a substantial increase in the number of appliances fitted during the year. This is about 12% greater than last year, 2,725 pieces of apparatus having been installed.

Blackburn.

The amount of gas made at Blackburn during the past 12 months totalled 1,867,079,000 c.ft., a decrease of 18,702,000 c.ft., or 1·72%, on the previous year. The value of appliance sales through the gas showrooms was £17,992, an increase of £1,400. and approximating £360 per week. The coal carbonized amounted to 48,916 tons, against 50,504 tons, a decrease of 1,588. Working results obtained were: Gas 21,814 c.ft. per ton of coal, coke 8·77 cwt. per ton, and tar 16·76 gallons per ton. Receipts from residuals, after deduction of working expenses, had been maintained, showing a return of 10s. 8·4d. per ton of coal. The expenditure on revenue account was £125,233, against £127,952 (a reduction of £2,719), while income was £192,092, against £195,801, or £3,700 less than the previous year. Gross profit amounted to £66,859, compared with £67,848, a decrease of £989. After meeting income tax of £10,088 (against £9,246) and interest and sinking fund charges, £60,037, there remained a net profit of £4,059. Capital expenditure out of revenue for new meters was £1,341, leaving a balance of £2,718 for the reduction of the outstanding amount debited against the Department.

Lisburn.

The auditors' report on the accounts of the Lisburn Gas Undertaking showed that the profits for the year amounted to £1,239—an increase over the previous year of £35. The Chairman of the Urban Council (Mr. J. D. Barbour) said this was achieved despite the increase in discount allowed to consumers last year. A resolution congratulating the Manager (Mr. A. S. Brook) and all employees of the Undertaking was passed.

Lincoln.

The working expenses were reduced by a further £5,932, making approximately £11,000 in the past two years. The increase in rates cost over £1,200, and the Department now pays over £9,000 per annum in rates. The total quantity of gas produced amounted to 574 million c.ft.—an increase of 14 million c.ft. The gas consumption increased by 58 million c.ft. The gross profit for the year was £19,975, and after deducting debt and interest charges, there is a net profit of £3,316. The credit balance now stands at £22,452, compared with £3,275 four years ago. The Department has over 18,000 consumers, while there are some 13,000 gas cookers in use. The Showroom sales show an increase of £2,565, or 50%. More than 1,000 cookers have been sold in the past 12 weeks, it is stated.

Stafford.

The annual report of the Gas Committee of the Stafford Town Council for the year ended March 31 states that the gross profit was £16,465, a reduction of £2,662, as compared with the previous year. The net profit was £3,347. The amount of gas made was 341,850,000 c.ft.—a decrease of 6,572,000 c.ft.—of which 17,040,600 was unaccounted for, but it was estimated that an additional 7 million c.ft. would have been accounted for but for the earlier than usual reading of consumers' meters in the March quarter. During the year 16,990 tons of coal were carbonized, the make per ton being 20,120 c.ft., compared with 20,459 c.ft. last year.

PERSONAL

STAFF CHANGES AT FOLKESTONE.

Several staff changes are announced in connection with the Folkestone Gas and Coke Company. Mr. F. SOUTHGATE, who was for many years Manager of the Hythe branch of the Company, and, latterly, Works Manager at Folkestone, is retiring on June 30.

In consequence the following appointments have been made: Mr. G. H. KENYON, B.Sc., of the Engineering Staff of the Gas Light and Coke Company, has been appointed Assistant Engineer from July 1. Mr. J. B. A. MACDONALD, B.Sc., formerly on the staff of the Croydon Gas Company, and, later, Technical Assistant at Folkestone, has been appointed Deputy Assistant Engineer. Mr. R. G. ROLFE, Distribution Superintendent of the Godalming Gas and Coke Company, and at one time with the Dover Gas Company, has been appointed Distribution Superintendent at Hythe.

* * *

Mr. HAROLD COPP, Engineer and Manager at the Hull Station of the British Gas Light Company, Ltd., asks us to announce that he will shortly be retiring from active service with the Company.

Mr. Copp desires us to place on record his great appreciation of the unfailing kindness and consideration which have been extended to him by the Chairman and the Directors of the Company during his long and happy period of service with them for twenty years.

* * *

The Directors of the Gas Light and Coke Company have filled the vacancy of Transport Manager, caused by the death of Mr. Malcolm Hunter, by appointing Mr. H. M. LAWRENCE, Assistant to the Coke Manager.

* * *

Mr. D. M. MATHESON, who has been Assistant Secretary to the Gas Light and Coke Company for the last six years, has retired to take up an appointment as Secretary of the National Trust for Places of Historic Interest or Natural Beauty. His place has been filled by Mr. B. F. WOOD, who has been on the staff of the Company for the past seven years, latterly in the Secretary's Department.

* * *

Mr. FREDERICK STEPHEN DOWNS, Assistant Engineer at Bishop's Stortford, was married on June 2, in London, to Ethel Lilian, the daughter of Mrs. and the late Mr. T. Newton, who at one time was the District Superintendent of the Hereford Corporation Gas Department.

Correspondence

Who Sells the Cheapest Gas?

SIR,—Referring to the recent correspondence in the "JOURNAL," may I correct Mr. Halkett in his letter which appeared in your issue of June 6, when replying to question 895, which was:

> "How does that basis price of 7d. per therm compare with the basic price of other gas undertakings in this country?"

He stated:

> "I should say, with the exception of one, that it is the lowest. I think the basic price of the Bath Gas Company is lower."

Under the Sunderland Gas Order, which came into operation on July 1, 1933, the basic price was fixed at 6d. per therm and the highest basic price operating in our area of supply is 6·6d. per therm, which is considerably lower than the Sheffield basic price.

Yours, &c.,
J. H. CURRY, *Secretary.*

Sunderland Gas Company,
Fawcett Street, Sunderland,
June 11, 1934.

All-Gas Swimming Baths.

SIR,—While not wishing to detract from the force of your recommendation to all gas undertakings to study the example of Burnley and endeavour to follow it, may I point out that the figures of cost given are not very encouraging. £451 for 8,659,000 c.ft. works out at 12½d. per thousand, or, if the calorific value is 500, at 2½d. per therm. There are not many places where the cost of manufacture would make such a price practicable.

Yours, &c.,
ARTHUR VALON.

5, *Victoria Street,*
Westminster, S.W. 1,
June 7, 1934.

The Bodmin Gas Company was awarded first prize in the class for the best decorated trade vehicle at the local Carnival on Saturday, June 2.

The Waverley Association of Gas Managers are holding their Annual Meeting in the Goold Hall, St. Andrew Square, Edinburgh, on Friday, June 29, when the President, Mr. George P. Mitchell, of Worcester, will take the chair at 10.30 a.m. and give an address which will be open to discussion. The meeting will adjourn for luncheon at 1.15 p.m. in the North British Station Hotel, Princes Street. The Golf and Bowling Competitions will be held on the afternoon of Thursday, June 28, the former starting at 1.30 p.m., the latter at 2 p.m.

After a Keen Division of Opinion and a long debate on the rival merits of gas and electricity, the Southgate Borough Council have decided to illuminate their open air bath at Barrowell Green by gas. The Tottenham and District Gas Company are carrying out the contract, and it is proposed to illuminate the bath with six 6,000 candle-power lamps, besides smaller lamps at other angles around the pool. The path is 150 ft. by 50 ft. The contract is an achievement for the Gas Company, as the Council have hitherto favoured electric lighting for streets and buildings.

The Following Tenders were accepted by the Stourbridge Town Council in connection with the extension of their gas-works, amounting in all to £48,000: The Woodall-Duckham Vertical Retort and Oven Construction (1920), Ltd., for vertical retort plant, Messrs. Westwood & Wrights, Ltd., Brierley Hill, for a spiral-guided gasholder, with a capacity of 1,500,000 c.ft., and Messrs. Thos. Vale & Sons, Ltd., of Stourbridge, for the building of a ferro-concrete base. The paying off of two old loans has made possible a reduction in the price of gas by 2d. per 1,000 c.ft. to the smaller domestic users and by 1d. to the larger consumers. An additional allowance of 3d. per 1,000 c.ft. has been made on the surcharge to consumers in Blakedown.

Institution of Heating and Ventilating Engineers.—The Summer Meeting of this Institution will be held at Hastings on June 18, 19, and 20 next under the Presidency of Mr. R. Comyn Ching. The headquarters will be at the Queen's Hotel.

A Suggestion that 2,000 municipal houses in Glasgow, at present lit by gas, should be illuminated by electricity was defeated at a meeting of the Housing Committee. The cost of the change-over would have been £18,500, which would be equivalent to ½d. on the rates.

Parkinson & Cowan, Ltd.—The Thirty-Fourth Annual Report states that after making provision for redemption of debenture stock (£3,096), debenture interest, income-tax, and depreciation of buildings, &c., the net profit for the year amounted to £23,273. The amount brought forward on Jan. 1, 1933, was £36,179, from which has to be deducted the preference dividend paid in May, 1933 (less income-tax), leaving £8,939. After deduction of preference dividend (less income-tax), to March 31, 1933, there is a credit on profit and loss account at Dec. 31, 1933, of £19,509, out of which there was paid on March 31, 1934, half-year's preference dividend (less income-tax) to Sept. 30, 1933, leaving a present balance at credit of profit and loss account of £6,806, which the Directors propose to carry forward. Reorganizations of certain important Home Subsidiaries—commenced in the latter half of 1932—which were designed to improve methods of manufacture and to introduce new models, were vigorously continued throughout 1933, and the cost has been largely felt in the year under review. Although conditions must continue difficult until such reorganizations are completed, the benefits to be anticipated are already indicated by increases in turnover in all Departments. With the gradual return to more normal economic conditions in Australasia, the Subsidiaries trading there continue to show improved results.

British Commercial Gas Association.

Yorkshire District Conference.

The future of gas in the home, as a scientifically-controlled fuel for industrial processes, and as a motive power for transport, were subjects discussed at the Yorkshire District conference of the British Commercial Gas Association at Harrogate on June 1.

In a civic welcome to the 150 delegates and visitors to the conference, the Mayor of Harrogate (Mr. J. H. Newsome) applauded the work of the Gas Industry in improving conditions in the home. He referred to the healthy competition between gas and electrical enterprises as being in the interests of all parties, including the consumer, and said that inventions on both sides, especially in the domestic field, had brought about great labour saving.

Sir Percy Alden (Chairman of the British Institute of Social Services) upheld the right of tenants to choose the form of heat and light in their homes, remarking that he thought gas and electricity both had important parts to play in the life of the community. It was only a question of how the work was to be divided. His experience, however, had taught him that the housewife preferred gas because of its convenience.

A suggestion that Harrogate could place itself in the forefront of the world's health resorts by being the first smokeless town was made by Mr. H. E. Bloor, of York, in proposing the toast of the Mayor and Corporation of Harrogate, at a luncheon given by the Harrogate Gas Company. He named gas and its bye-product, coke, as economical means to that end.

The Mayor of Harrogate replied.

The toast of "The Gas Industry" was proposed by Sir John Eaglesome (President of the Leeds Chamber of Commerce), and was responded to by Mr. John E. Cowen (Chairman of the Newcastle-upon-Tyne and Gateshead Gas Company).

The Mayoress of Harrogate extended a welcome to women visitors at the afternoon session of the conference, at which an address was given by Mrs. Eileen Murphy, on "Planning the Home."

Eastern District Conference.

Councillor A. L. Bower, Chairman of the Corporation Gas-Works Committee, presided at the Eastern District Conference of the British Commercial Gas Association at Lincoln on June 1, and in addition to the delegates there were present the Mayor (Councillor G. Deer), the Corporation Gas Department Manager (Mr. G. Wright), and members of the Lincoln Corporation Gas-Works Committee.

Welcoming the delegates, the Mayor said he had watched the development of Lincoln's Municipal Gas Undertaking and he was confident that the new Gas-Works were among the best in the country.

Mr. Liddall, who addressed the Conference, paid a tribute to the Lincoln Gas Undertaking and the Engineer and Manager, Mr. George Wright.

Gas was first manufactured in Lincoln in 1830, he said. The number of street lamps was then 76, and the price of gas was 13s. 6d. per 1,000 c.ft. At the present time the undertaking manufactured annually 560 million c.ft. of gas, supplied nearly 18,000 consumers, controlled 1,880 public lamps, and at one time or another had contributed over £70,000 to the relief of rates. To cope with the expansion of the Undertaking new and excellently-planned showrooms had been opened in Silver Street, a new gasholder had been erected, and in 1932 the work of modernizing the Gas-Works was begun. Lincoln now had a modern gas-making plant, equipped with the latest apparatus for tar extraction, purifying, and washing, and able to meet the growing needs of the community.

Councillor Carr proposed a vote of thanks to Mr. Liddall.

Following the Conference, the delegates, visitors, and guests attended a luncheon at the Saracen's Head Hotel, where they were addressed by Dr. Burgin, M.P., Parliamentary Secretary to the Board of Trade.

Eastbourne to Take Over Seaford.

Notice is given by the Eastbourne Gas Company of their intention to apply for a Special Order to authorize them to purchase the undertaking of the Seaford Gas Company, Ltd. It is proposed to increase the Eastbourne Company's capital and to issue 5% preference stock in exchange for the Seaford Company's ordinary, additional, and preference shares.

Sir Arthur Duckham Memorial Fund.

Official List of Donations from June 2 to 8.

Name and Town.	Amount. £	s.	d.
County Borough of Birkenhead Gas Department	30	0	0
The General Manager, Engineer-in-Chief, Engineering and Chemical Staffs of the Birmingham Gas Department	22	0	0
North British Association of Gas Managers (Commercial Section)	3	3	0
Sheppey Gas Company, Sheerness	9	0	0
Tunbridge Wells Gas Company	25	16	0
Donations (5) paid above	£ 89	19	0
Donations (593) paid previously	9,757	11	2
Total Donations (598) paid	£9,847	10	2
Donations (7) promised	546	12	0
Total Donations (605) paid or promised	£10,394	2	2

Glasgow and Coke Oven Gas.

Final Rejection of Offer.

The Corporation of Glasgow at their meeting on June 7 finally decided to reject the offer to supply coke oven gas which had been made by Messrs. William Baird & Co., ironmasters, Gartsherrie. This offer, which has already been reported in these columns, was made about a year ago and was for a supply of 6,250,000 c.ft. of gas per day at a price of 8·4d. per 1,000 c.ft.

The Corporation appointed a special Sub-Committee to investigate the offer. This Committee considered the situation from all aspects and, after consulting the authorities at Sheffield and Leeds, advised that the offer be rejected. The minute of the Sub-Committee rejecting the offer was discussed by the Corporation, and after arguments had been heard from both sides the minute was adopted by 51 votes to 47.

As a result of the decision of the Corporation not to accept the offer of coke oven gas, Messrs. William Baird & Co. have stated that they cannot contemplate any extension of their plant at the present time. It was the intention of the Company to erect modern coke ovens and blast furnace plant in an endeavour to re-establish the Scottish pig-iron industry and put it on a sound competitive basis. The success of this scheme, it is stated, depended on the obtaining of an outlet for the gas produced by the coke ovens. The refusal of the Corporation to take the gas, therefore, means that the scheme of reconstruction cannot now be undertaken.

Forthcoming Engagements.

June 14.—S.B.G.I.—Council Meeting, 11.15 a.m.

June 16.—London and Southern Junior Association.—Summer Visit to Hastings.

June 20.—B.C.G.A.—Meeting of Executive Committee, 12 noon.

June 21.—Southern Association (Western District).—Commercial Meeting at Rougemont Hotel, Exeter, 2.30 p.m.

June 28.—Coke Salesmen's Circle.—Visit to Beckton Works of the Gas Light and Coke Company. Paper on "The Investigation and Settlement of Coke Complaints."

June 29.—Waverley Association of Gas Managers.—Annual Meeting in Edinburgh.

July 7.—Western Junior Association.—Summer Meeting.

Sept. 6.—North British Association of Gas Managers.—Annual Meeting in Inverness.

Sept. 24-26.—B.C.G.A.—Annual General Meeting and Conference at Sheffield.

Nov. 6 and 7.—I.G.E.—Autumn Research Meeting.

National Gas Council.

The Secretary of the N.G.C. asks us to announce that there will be no meeting of the Central Executive Board of the Council, or of the Central Committee of the Federation of Gas Employers, during the month of June.

THE NEWS—continued.

New Scale of Charges at Chesterfield.

The Chesterfield Gas Committee has decided upon a revised and reduced scale of charges for gas. The new scale, which becomes operative on July 1, is as follows:

First	10 therms per quarter	10d.	per therm
Next	20 ,, ,,	8d.	,,
,,	70 ,, ,,	7d.	,,
,,	400 ,, ,,	6d.	,,
,,	500 ,, ,,	5d	,,
Over	1,000 ,, ,,	4d.*	,,

* *Less* 5% for cash discounts.

Householders within the Borough will be offered an alternative basis of charges for gas supplied as follows: There will be a charge of 12s. 6d. per quarter for service, with gas at 5d. per therm, less 5% discount for cash. Consumers outside the Borough will have the same rates as those within, except that they will pay an extra 1d. per therm.

Dublin's Live Hoardings.

Novel Gas Advertising Scheme.

This idea was tried out by the Alliance and Dublin Consumers' Gas Company about twelve months ago by installing an instantaneous water heater (working) in a hoarding which abuts on the footpath in a district where the local authority have, in the past few years, erected a large number of new dwellings. The water heater, with basin, was erected in a hut constructed at the back of the hoarding, with gas and water supply, and waste; and the increased business obtained from this exhibit encouraged the Company to carry the idea further. This year five such exhibits are in operation, and the number is being increased.

Example of "Live" Hoarding at Dublin.

Apart from the cost of installation, which varies according to the particular circumstances, the cost of running the exhibit, including wages, space, posters and gas, is well covered by the sum of £5 a week, or the equivalent of one very small space in a daily paper. The public interest, which these exhibits have created, and the business which has resulted, has more than justified their efforts.

The original intention was to have the water heater automatically controlled so as to operate only during certain periods of the day when the people were passing in numbers, to and from work, or during the shopping period, but owing to the number of people making inquiries it is found more convenient to have a man in attendance.

During the winter the exhibits can be operated with great effect in the evening by hidden interior lighting, and the effect of the flow of steaming water is very telling. The Dublin Company have considerably improved and developed their ideas on outdoor exhibits, particularly of hot water apparatus. They use the slogans "Gas in Pennyworths," "Five Gallons of Scalding Water for 1d."

Mr. H. F. Cotton, the Company's Distribution Engineer, to whom we are indebted for the information regarding this excellent business-getting scheme, adds that they intend to concentrate on increasing the sale of hot water apparatus, so as to reach the happy position of a town like Philadelphia (which he visited with the Institution of Gas Engineers last year), where there are something like half a million gas cookers and almost as many water heaters in use.

Wales and Monmouthshire Junior Gas Association.

The Twelfth Annual Meeting of this Association was held at Swansea on Saturday, April 21—Mr. H. S. BARTLETT (President) was in the chair.

The Council's report again acknowledged the support of the Senior Association and of their Secretary, Mr. Octavius Thomas, as well as the interest taken by the chief officials of undertakings in the area. Reference was made to the retirement from active business of Mr. Octavius Thomas, who, until recently, was Engineer and Manager of Rhondda Gas and Water Undertaking, and a message was sent wishing him many happy years in which to enjoy his increased leisure.

The Treasurer's Report and Accounts showed considerable improvement in the financial position.

The appointment of officers for the ensuing year then took place and resulted in the following being elected:

President.—Mr. A. D. Howells (Neath).
Senior Vice-President.—Mr. J. F. Rust (Newport).
Junior Vice-President.—Mr. J. H. Chapman (Swansea).
Hon. Librarian.—Mr. K. H. H. Langford (Cardiff).
Hon. Treasurer.—Mr. B. J. Bell (Cardiff).
Hon. Secretary.—Mr. R. S. Snelling, F.C.I.S. (Newport).

Messrs. D. E. Wilkins (Swansea) and W. J. Viney (Cardiff) were elected to fill vacancies on the Council.

Following the business meeting the members were addressed by Mr. W. H. Johns, M.Inst.Mech.E., President of South Wales Branch of the Institute of Mechanical Engineers, Engineer and Manager of Swansea Gas Light Company, on the many and varied problems confronting those engaged on the commercial side of gas undertakings. He outlined the steps which were being successfully carried out at Swansea to retain and increase the use of gas for all purposes—lighting, heating, water heating, and cooking in the domestic fields, in public lighting, and in many other directions.

UP-TO-DATE APPARATUS.

The provision of the most up-to-date and efficient apparatus; the supply of their chief commodity at a uniform and consistent quality and pressure; consideration of consumers' requirements; courtesy and genuine service, would, he said, enable them to meet competition from any and every source, and to do more than hold their own.

Votes of thanks to Mr. Johns and Swansea Gas Light Company concluded the meeting.

Gas Engineers Visit Industries Exhibition.

Enterprise at Cardiff.

One of the methods of getting bulk purchasers and users into personal touch with the manufacturers who are showing their products at an exhibition is to arrange visits by representative delegations from the various professional, technical, and trade organizations in the area.

The Gas Industry took the lead in this respect at Cardiff when members of the Wales and Monmouthshire Association of Gas Engineers and Managers attended the Industries Exhibition.

Mr. George Williams, the Chairman, and Mr. D. J. Davies, the Secretary of the Industrial Development Council, welcomed the visitors, who were represented on the platform by Mr. I. G. Jenkins, Abertillery, President of the Association; Mr. H. D. Madden, Mr. Bertram Turnbull, and Mr. Wilfred Jones, of the Cardiff Gas Light and Coke Company; Mr. W. H. Johns, Swansea; Mr. D. Muir, Pontypridd; and Mr. Octavius Thomas, Porth, the Secretary of the Association.

Mr. George Williams referred to the splendid way in which the Association were supporting the objects of the exhibition and spoke of the good work of Mr. H. D. Madden on the Committee of the Industrial Development Council and in all matters affecting the rehabilitation and expansion of industries within the area.

AVENUES FOR NEW INDUSTRIES.

Mr. I. G. Jenkins, in responding, congratulated the Industrial Development Council on the energetic way in which it was exploring the various avenues for the establishment of new industries and, in that way, assisting in relieving unemployment.

The Gas Industry, he said, was glad of the opportunity to co-operate with the Council in the exhibition, and to show the public the many ways, both in the home and in industry, to utilize gas, which lightened the burden of the housewife and provided facilities for cooking, heating, and hot water supply second to none. In industry gas had

THE NEWS—*continued.*

lightened much of the laborious work, and at the same time effected economies in working costs.

A gas undertaking of the size of the Cardiff Gas Light and Coke Company carbonized some 130,000 tons of coal per annum, equivalent to the total output from a fairly large colliery. The Cardiff Gas Undertaking also gave direct employment to over 700 workers, apart from the indirect employment to contractors' workmen, &c.

The recent experiments in the use of compressed gas for mechanically propelled road vehicles had opened up another field, and he hoped the time was not far distant when gas derived from British coal would be the motor fuel of the future. It was interesting to note that a new gas-filling station was to be opened in Lincoln.

A vote of thanks was accorded to the speakers, on the motion of Mr. W. H. Johns (Swansea), seconded by Mr. H. D. Madden.

The visitors afterwards made a tour of the stands, and many valuable business contracts resulted.

Gas Merger Plan.

Solihull and Knowle Companies.

According to the *Financial Times*, the Solihull Gas Company is seeking powers to take over the undertaking of the Knowle and District Gas Company. It is intended to create and to issue consolidated and preference shares against holdings of ordinary and preference shares in the Knowle Company. Provision will be made to compensate the Directors, Auditors, and certain officers of the Knowle concern for loss of office.

The plan involves conversion of the original and the new ordinary shares of the Solihull Gas Company into consolidated shares of £1 with such rights as the Board of Trade Order will allow. It also provides for conversion of the preference into preferences shares of £1 each. Further, consolidated and preference shares will be created and issued in substitution for the existing ordinary and preference.

Authority is sought to raise additional capital in the form either of consolidated shares (which will have a new scale of voting) and/or preference shares or stock. It is planned that the Directors shall prepare and put in force a profit-sharing scheme for the Company's employees.

The Solihull Company's issued capital is £62,902 out of £63,000 authorized.

Trade Notes.

Complete Gasification Plants for Prestonpans.

The Prestonpans District Gas Company, Ltd., has placed an order with Messrs. Tully, Sons, & Co., Ltd., for two 300,000 c.ft. per day complete gasification plants, including waste-heat boiler, mechanical operation, &c.

Progas Company, Ltd.

Mr. T. Coe, of Halifax, representative of the Progas Company, Ltd., in the Cheshire-Lancashire-Yorkshire area, has changed his address to Norton Towers, Halifax. Telephone number: Halifax 61149, as before.

Alexander Duckham & Co., Ltd.

A new method for hardening steel surfaces by means of the lubricant and, therefore, providing a remedy for the pitting and corrosion which takes place when metal parts are subjected to heavy loads or to rapid vibrations is manufactured by Messrs. Alexander Duckham & Co., Ltd., 16, Cannon Street, E.C. 4. The "Keenol" lubricants contain zinc oxide in colloidal form. The presence of the zinc oxide makes the lubricant anodic to steel and creates an electrolytic couple, which forms an adherent film on the contacting surface, thus preventing corrosion or pitting.

New Manchester Premises for "Pifco."

The foundation stone was laid on June 5 by proxy for Mrs. J. Webber (due to absence abroad) by her husband, Mr. J. Webber, the Managing Director, of new premises for Provincial Incandescent Fittings Company, Ltd., at Shudehill, Manchester. These new buildings have a frontage of 63 ft. on one of the principal roads in Manchester, and comprise five storeys and basement. There will be office accommodation in the new building for over 100 clerks, and most modern office equipment is being installed. The removal has been necessitated by the increasing demand for "Pifco" products since the adoption of national advertising by the Company.

Quick to take advantage of current events, Richmonds devised this topical display for their Queen Victoria Street Showrooms. The first of the series of Test Matches has here been cleverly linked up with their popular "Bungalow" "New World" Cooker. This up-to-date display attracted considerable attention.

Malta and Mediterranean Gas Company, Ltd.

ANNUAL MEETING

The Annual General Meeting of the shareholders of the Malta and Mediterranean Gas Company, Ltd., was held on Tuesday, 5th June, 1934, in the London Offices of the Company, 5, Great Winchester Street, E.C. 2—Mr. A. M. PADDON, M.Inst.C.E. (Chairman of Directors), presiding.

The SECRETARY (Mr. G. Murray Burton) read the notice convening the meeting, together with the certificate of the Auditors. The seal was duly affixed to the list of shareholders, and by general consent of those present it was agreed that the Directors' report and statement of accounts be taken as read.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN, in moving the adoption of the report and accounts, said that, compared with the previous statement, the outstanding disparity was a reduction in the surplus amount of profit, which was explicable in the most simple manner. It was entirely occasioned by a reduction in the price of gas which the Directors decided to make some ten months ago. That reduction represented £2,200, which, of course, was deducted from what would have been the profit of the Undertaking. But when they looked at the actual results of the year's working they were only £309 short as reflected in the diminution in the carry-forward. In all other respects the accounts compared very closely with those of twelve months ago, and, indeed, had some special excellencies of their own.

The amount of gas sold was only less by 1·35%, which simply reflected common conditions in the Gas Industry throughout Europe. In almost every case in this country they had had to record some slight diminution in business due to current conditions and the high rate of income-tax which they had to support. But matters would not go beyond a certain extent in that regard, and although they might have to experience some further decrease in sales, there was no reason why they should not stabilize the position in the near future.

SUBSTANTIAL PRICE REDUCTION.

They had carried some heavy charges for mains to revenue account from capital, and taking this into consideration the real deficit was less than £30, which was satisfactory taking into consideration the fact that they had deliberately made a present of £2,200 to their consumers in the price of gas. It might be asked why they had done this. The answer was that they had many considerations to deal with; the political situation, competition, and their consumers had to be taken into account, and while the figures showed that they had been able to do this without prejudicing the accounts, they would realize that it was a wise and diplomatic move to make. They had reduced the price by 6d. per 1,000 c.ft., which was a vastly larger reduction than could have been made by a gas undertaking in this country—one which would shatter the accounts of any Metropolitan or suburban company here—so that it was gratifying to have been able to do this without showing any disparity in their accounts. The price of gas in Malta was still high, which was in itself a good reason for what they had done; but it was not higher than many undertakings in this country and was the cheapest price in the Mediterranean in spite of the fact that there were several undertakings in this large area which experienced superior facilities. Business was definitely better as a result of the lower standard of price which they had instituted.

Turning to the accounts, it would be seen that as regards economy and efficiency these corresponded closely with those of the previous year. He had already mentioned that they had charged to revenue some £800 for mains which could quite legitimately have been charged to capital; but in all other cases the details followed those of the previous accounts. To sum up it would be observed that they had brought into the profit and loss account the sum of £25,488, while they were taking out of it £25,129, which was £309 less—an amount which they could very well afford as the cost of having improved their commercial relations with their consumers in Malta.

As regards the balance-sheet, there was even more gratifying information to give them. Their investments stood at a book value of £116,732, their capital on the other side being represented at £123,000. The former sum was, however, only the book value of their investments, which, as a note indicated, stood at March 31, 1934, at a valuation of £158,178. So there was no lack of security in connection with the finances of the Company.

THE FUTURE.

In regard to the future, they might have to experience some further small shrinkage in their sales of gas, but it would not be great. They could not sell gas at a high return consistent with a low price. Experience in France—and he was fully conversant with conditions in that country—indicated that there was an irreducible minimum in the amount of gas used, independent of the price. The French were extremely careful in regard to expenditure, but the price of gas was high compared with this country, and the amount consumed per head was very much less, though it never went below a certain figure. They had to compete in Malta with very cheap petroleum, and most of the cooking was done on oil stoves. This petroleum was hawked through the streets of Malta at 4d. a gallon. For many years they had been brought to regard electricity as the chief competitor of gas, as it was more showy, but the real competition they had to meet was from cheap oil.

Looking into the economics of their processes and administration, these compared favourably with any gas undertakings in this country. The efficiency of their works and the economy of the operations of the Company, together with the care, skill, and attention to detail, were as high as any undertaking of which he was conversant—and he knew a good many. They had bought all their coal for the present year, and the shareholders could look forward with confidence to the future, for the Directors felt that they would be able to show equally satisfactory results in twelve months' time.

The CHAIRMAN then formally moved the resolution for the adoption of the report and accounts, which was seconded by Mr. A. W. OKE.

Alderman F. W. CHURCH, in thanking the Chairman for his remarks, said that the shareholders felt very comfortable in regard to the balance-sheet. He considered the reduction in the price of gas a good move, for most people would now use more gas. He was very glad to see their Engineer and General Manager in Malta (Mr. A. E. Buckley) there that day, and observed how well he was looking after their interests.

The resolution was then put to the meeting and carried unanimously.

DIVIDENDS.

The CHAIRMAN thereafter moved:

> That final dividends at the full rates be declared on the first and second preference shares and a dividend, of 5% (free of income-tax) on the ordinary shares, making for the year (with the interim dividends paid in December last) a total distribution of 7% on the first preference shares, 7½% on the second preference shares, and 10% (free of income-tax) on the ordinary shares.

Mr. E. L. BURTON seconded this resolution, which was unanimously agreed to.

RE-ELECTION OF DIRECTOR.

The CHAIRMAN moved the re-election to the Board of Mr. E. L. Burton, being the Director retiring by rotation. The proprietors realized, he remarked, that they had a very great addition to the Board when they persuaded Mr. Burton—busy man that he was—to join them. There was no one with a greater grip and conversancy of the Gas Industry; and the ordinary investor knew that his money would be safe if the name of Mr. Burton appeared among the Directors of a Company.

Mr. A. W. OKE seconded the resolution, which was carried unanimously.

Mr. E. L. BURTON, in acknowledging his re-election, thanked the Chairman for the high compliment he had paid him. He really felt some little diffidence in being elected to the Board, as the Burton family seemed to dominate the Company; and if he had not felt confident that the two other members of the family were properly carrying out their duties, he would not have continued to serve. But he believed that they were doing their best, and so he would continue to do his best.

CONVERSION OF THE COMPANY'S SHARES INTO STOCK.

The CHAIRMAN next moved:

> That the existing issued Capital of the Company shall, by virtue of the powers conferred upon the Company in General Meeting under Article 3 of the Articles of Association, be converted into stock as from the date of this resolution, in the manner following, that is to say,
>
> 15,000 fully paid ordinary shares of £5 each into £75,000 of ordinary stock transferable in multiples of £5.
>
> 6,000 7% non-cumulative first preference shares of £5 each into £30,000 of 7% non-cumulative first preference stock transferable in multiples of £5.
>
> 3,613 7½% non-cumulative second preference shares of £5 each into £18,065 of 7½% non-cumulative second preference stock transferable in multiples of £5.

Commenting upon this resolution, the CHAIRMAN remarked that this was purely a matter of arithmetic, and was more in conformity with company practice, giving greater facilities in regard to the transfer of shares and in dealing with them. They were able to deal with this resolution by notice in General Meeting.

Mr. E. L. BURTON seconded the resolution, which was unanimously agreed to.

RE-APPOINTMENT OF AUDITORS.

On the proposition of Alderman CHURCH, seconded by Mr. F. R. SMITH, the Company's Auditors, Messrs. William Cash, F.C.A., and Hyde Clarke Burton, F.C.A., were re-appointed for the ensuing year at a remuneration of forty guineas each.

VOTE OF THANKS TO STAFF.

The CHAIRMAN went on to propose a hearty vote of thanks to the staff of the Company both in London and Malta. He need

not, he said, go into any detail in regard to this, because he had already observed how favourably everything compared with results in this country. But the special difficulties in Malta added a burden to the officers and rendered their task more arduous than it would be if they were working here. He hoped, therefore, that the shareholders would send out to them this vote as an encouragement for the work they had done.

The vote was seconded by Mr. A. D. DODGSON and unanimously accorded.

Mr. A. E. BUCKLEY, in acknowledgment, said that in his opinion the soundness of this Undertaking was due to the guidance he received from his expert Board of Directors. He was served in Malta by two Englishmen and 150 Maltese, and they all pulled together. It would give him great pleasure when he returned to bring to the notice of the Maltese staff especially how their services were appreciated.

This concluded the business of the Ordinary General Meeting, and an Extraordinary General Meeting immediately followed.

EXTRAORDINARY GENERAL MEETING.

The SECRETARY having read the notice convening the meeting,

The CHAIRMAN said that the resolution he was about to submit was actually of no great importance, and, like the resolution at the Ordinary Meeting, was merely to bring the practice of the Company into conformity with modern conditions. Their Company was formed some 75 years ago, and, of course, some of the Articles remained as they were, being inconsistent with modern company affairs. This resolution was to assist the staff in regard to a great deal of redundant and unnecessary work. He then moved:

> That Article 110 of the Articles of Association be amended in the manner following, that is to say,
>
> There shall be substituted for the words " two Directors " the words " one Director " so that the amended Article shall read as follows:
>
> Any sum paid on behalf of the Company which shall amount to £5 or upwards shall, so far as practicable, be paid by cheque, draft, or order on the Company's Bankers, which shall be signed by at least one Director, and countersigned by the Secretary, and no such payment shall be made without the order or authority of some meeting of the Board, or of a committee duly authorized by the Board in that behalf.

The sole difference in the Article, said the Chairman, was the substitution of one Director instead of two, and he thought this was a measure of convenience which would not be grudged them.

Mr. A. W. OKE seconded the resolution, which was unanimously agreed to.

The proceedings terminated with a hearty vote of thanks to the Chairman and Directors on the proposition of Alderman CHURCH, seconded by Mr. C. J. DAUN, which was duly acknowledged by the CHAIRMAN.

Croydon Gas Company

ANNUAL CO-PARTNERSHIP MEETING

A large gathering of co-partners and their wives attended the Twelfth Annual Meeting of co-partners in the Croydon Gas Company, held on Tuesday, May 29, at the North End Hall, Croydon.

Mr. WILLIAM CASH (Chairman of the Board of Directors) presided and submitted the report and accounts of the co-partnership scheme, and the pension, widows', and orphans' fund, being supported on the platform by other Directors of the Company, and also the senior officers, including Mr. W. J. Sandeman (General Manager), Mr. F. F. Wood (Secretary), Mr. W. Grogono (Engineer), together with Mr. M. O. Coates (Editor of the Company's Co-Partnership Magazine) and representatives of the Co-Partnership and Works Joint Committee.

At the outset Mr. Cash extended a hearty welcome to all present on behalf of the Directors. He recalled that their co-partnership scheme was founded in 1909, and that fact was emphasized in the last issue of their Co-Partnership Magazine, which was started in 1913 and celebrated its 21st birthday in the last issue. Mr. Cash took this opportunity of congratulating the Editors and contributors who had been responsible for the success of the Magazine.

It seemed unnecessary to remind them of the general principles underlying co-partnership; they might be summed up in a very few words—namely, that they worked together and shared together with the object of rendering the best possible service to those they served. And in working together and sharing together they got the first principles of co-partnership. Then they went further and called it co-partnership because they took their share of the profits and also had the opportunity of becoming shareholders in the undertaking. So it was something more than mere profit-sharing because they became partners in the full sense of the word. Then on the side of the Directors they saw the results of what the Board tried to do for the welfare of those who served them, and he would like to say how much they appreciated the work which was done by every member of the staff from the General Manager down to the last-joined office boy.

They really believed that through this system of co-partnership the Company derived the greatest possible benefit and the consumers in the town received the best possible service; and for that he would like to tender on behalf of the Board of Directors their thanks for what had been done during the past year. He had mentioned at the Annual Meeting of shareholders the good work of the staff, and the shareholders had passed a vote of thanks to them.

Mr. Cash went on to refer to the sick and benefit fund and to other ways in which the welfare of the staff was looked after. Most important of all, there was the pension fund as a provision for old age.

As regards the progress of the Company, they were adding new consumers at a substantial rate every year. In the new St. Helier Estate, for example, part of which lay within their area, over 2,500 houses were supplied with gas up to last March. In the Co-Partnership Magazine for May Mr. Sandeman had written a letter reviewing the progress of the Company in the past 21 years. The output of gas had increased from 1,471 to 3,000 million c.ft., while the number of consumers had increased from 41,000 to about 90,000. Last year they put out on the district 5,000 additional gas cookers and some 13,000 major appliances.

Mr. Cash referred with regret to the passing of their late Secretary, Mr. W. W. Topley, who was Secretary in 1909 when their co-partnership scheme was launched. He had retired some years ago; nevertheless, they greatly regretted that he had not been spared to enjoy a longer period of retirement.

THE ACCOUNTS.

Mr. Cash next turned to the report and accounts for the year ended March 31, pointing out that the number of co-partners was now 995. The bonus was at the rate of 7%—the same as the previous year, being the rate at which dividend on the sliding-scale stock of the Company was paid for 1933. The amount of bonus credited to co-partners at £12,793 was £140 more than the preceding year, and was calculated on average wages. Savings and deductions for life assurance were not quite as much at £8,618. The amount of interest credited to co-partners' accounts was somewhat less, as also was the amount invested by co-partners in the Company's stock at £2,811. The nominal amount of the Company's stock standing in the names of co-partners and annuitants was, on March 31, 1934, £32,482. The usefulness of the scheme was dependent upon members allowing their bonuses to accumulate for investment and thus be of permanent benefit to them.

Turning to the bonus account, it would be seen that the bonus declared amounted to £12,793, and the other side of the account showed how this amount was made up—namely, contributions to pension fund, £6,859, and co-partners' accounts, £5,933. All the co-partners had at the credit of their accounts at the beginning of the year the sum of £41,896; and at the end of the year it was increased to £42,973, which was satisfactory in itself. This amount was partly invested in the Company's own stock and carried interest.

PENSION FUND.

In regard to the pension, widows', and orphans' fund account, the balance brought in at March 31, 1933, was £327,385. Members' contributions amounted to £10,232, divided into £5,433 to the pension fund and £4,798 to the widows' and orphans' fund. The Company's contribution doubled this amount at £10,900, while their special contribution of £10,000 was being continued until their actuary said they might stop.

The amount invested in the names of the trustees was £310,230, which actually had a market value of £368,114—an increase of nearly £58,000 on the book value. The balance in the hands of the Company, uninvested, was £54,478, while there was an amount due from the Inland Revenue of £1,210 in respect of repayment of income-tax on investments. Their investments were in first-class concerns.

REPORT OF CO-PARTNERS' REPRESENTATIVES' COMMITTEE.

The report and accounts having been unanimously adopted, Mr. R. Richardson (Secretary to the Co-Partners' Representatives' Committee) presented his Committee's report. He referred to the restoration of free medical benefit to pensioners' wives who resided within their gas supply area. The Directors had given this without accepting the proffered increased contribution. The Board had also agreed to give free medical benefit to widows of their pensioners, which marked another milestone in their welfare work.

The prices of their stock stood very firm, and these prices were fixed so as to give co-partners an advantage to purchase

below the outside market value. The price of maximum dividend stock—they all held some of this—was £105 for £100 worth of stock; and co-partners who were prudent enough to invest in this stock a few years ago when it stood at between £80 and £90 could congratulate themselves on a profitable investment.

Their Committee was grateful, concluded Mr. Richardson, to the Chairman, Directors, and Management for their continued goodwill towards the employees of the Company and for the consideration shown to the members of this Committee.

Mr. W. J. SANDEMAN also accepted the Chairman's invitation to say a few words. He assured the co-partners that he had their interests at heart, for no business could prosper without contented employees; and from thirty years' experience at Croydon he knew that contented employees performed good work. His own task, he said, was made easier as a result of the sympathy he received from the Board of Directors. He referred to the new canteen which Mr. Grogono had designed at the works, remarking how much this would be appreciated by the men. The Directors and Officers had their business to perform, but the great amount of work was done by the co-partners.

While co-partnership was responsible to a very large extent for this happy state of affairs, he felt that the real reason was that they were all treated as human beings and not as machines. In conclusion, he emphasized that they were working under very happy conditions, and it was up to them to show their appreciation by doing everything in their power to increase the prosperity of the Company, and he looked to them all to maintain the Company in the position it now occupied.

LONG SERVICE AWARDS.

Long-service awards in the form of signed certificates were presented by Mr. Cash to the following co-partners who have completed twenty-five years' service with the Company:

Messrs. E. E. Badcock (Arrears Collector), S. R. Biggs (Clerk, Distribution Department), R. C. Floyd (Assistant Inspector, Purley), G. Fuller (Prepayment Collector), S. T. Geary (Fitter, Sales Department), J. Greenall (Fitter, Sales Department), H. H. Lamb (Fitter, Sales Department), W. B. Ward (Showrooms, Croydon), and W. Widdows (Stove Tester, Sales Department).

A hearty vote of thanks was accorded to Mr. Cash on the proposition of Mr. O. ARNOLD, the Chairman of the Co-Partners' Representatives on the Co-Partnership and Works Joint Committee, and the CHAIRMAN briefly responded, after which refreshments were served, and the remainder of the evening was devoted to a concert entertainment which was much enjoyed.

The Sheffield Gas Company's Bill

The Committee proceedings in the House of Lords on the Sheffield Gas Company's Bill (to prohibit the supply of coke oven gas within the Gas Company's area of supply except by the Company, or with the Company's consent) ended on Tuesday, June 5, when the Committee (over which Lord Amulree presided) approved of the Bill, with amendments.

The earlier proceedings of the Committee, which had occupied eight days, were reported in the issues of the "JOURNAL" for May 16 and 23. The case made by the Company was that they had taken responsibility for the construction of the gas grid in South Yorkshire, whereby to purchase coke oven gas from coke oven owners in the neighbourhood, who were constituent members of the South Yorkshire Gas Grid Company. They objected, therefore, to coke oven owners selling coke oven gas direct to industrial concerns within the Gas Company's area of supply, it being alleged that the United Steel Companies, Ltd., had arranged for a supply to an associated undertaking within the Gas Company's area.

All that remained on June 5 was for the Gas Company's Counsel to sum up, and for the Committee to give its decision.

Mr. W. E. TYLDESLEY JONES, K.C. (for the Company), commenting upon the claim, which had been made with great vigour by the opponents to the Bill, that the Sheffield Gas Company were asking for something unprecedented in demanding an enactment that nobody but themselves should supply coke oven gas within the Company's area of supply, said that a demand was not necessarily objectionable merely because it was unprecedented. Select Committees had not hesitated in the past to approve Bills to prevent injustice or unfair dealings as between parties of the type concerned with the present Bill; and there were ample precedents for giving the Sheffield Gas Company freedom from competition. The Company were seeking to prevent certain bodies acting in contravention of the whole basis on which an agreement was made and of a scheme which was sanctioned by Parliament to give effect to matters which had engaged the attention of two important Departmental Committees.

Whereas the United Steel Companies could make what profits they liked, the Sheffield Gas Company were subjected by Parliament to strict obligations and regulation of profits, in the interests of the public; and anything which amounted to unfair dealing between their consumers and themselves was a matter upon which Parliamentary assistance could be invoked. It was not merely a question of the effect upon the shareholders of the Sheffield Gas Company; the Bill sought to prevent injury to the Company as a public institution, charged with certain duties and under the control of Parliament.

The whole basis of the agreement between the Gas Company and the South Yorkshire Gas Grid Company was that anyone of the constituent members of the latter who had surplus gas should place it at the disposal of the Gas Company if the Gas Company could take it. The Gas Company had given up valuable liberty in renouncing their ability to deal with individual coke oven companies, with whom they could otherwise have concluded lucrative agreements separately, and had bound themselves to buy only from the Grid Company at a uniform price of 5½d. per 1,000 c.ft. It was also an obligation upon the Gas Company to push the sale of coke oven gas for industrial purposes, which meant that very low prices had to be quoted. The Sheffield Gas Company had had every reason to trust the constituent members of the Gas Grid Company, but in one case, it had been shown, that trust was misplaced. The United Steel Companies had impeded the Gas Company by taking away a consumer, and the withdrawal of that custom might affect the economy of the whole undertaking. Prior to the agreement, Mr. Benton Jones (Chairman of the United Steel Companies) had never said that he would be free to compete with the Gas Company; and if he had made that threat there would have been no agreement. If this were clever business, said Counsel, he hoped it was not indicative of the mentality of all big businesses in this country.

NOT A MERE SQUABBLE.

This controversy, he continued, was not a mere squabble between the United Steel Companies and the Gas Company. The prime object of the Bill was to protect the public interest, and that could be done only by prohibiting the threatened competition. The industries in the area were entitled to cheap gas at a general figure, which was far more important than that one consumer should be in a specially favourable position in respect of the price it paid for coke oven gas. He emphasized the desirability also, in the interests of public safety, that a statutory Company such as the Sheffield Gas Company, governed by strict regulations, should be in sole charge of the large volume of explosive gas passing through the street mains. If the area were covered with mains by people who had no serious responsibility it might be a serious matter. Again, the big combines could starve out small industries. If any small industry wanted cheap gas it could demand it from the Sheffield Gas Company; but if the supply were to be in the hands of the big combines, the small companies could be crowded out. There was still something to be said for the statutory company whose duty was to function for the public benefit.

Following Counsel's speech, the Committee deliberated, and subsequently announced its decision that the Bill be allowed to proceed, but with amendments. It must be provided that the consent of the Gas Company to a supply being given to a consumer in their area of supply from a source other than the Gas Company should not be withheld unreasonably; and that if there were any dispute as to whether or not such consent had been unreasonably withheld the matter should be settled by the Board of Trade. Principles to be considered by the Board of Trade in arriving at a decision, in addition to other relevant matters, were (*a*) the price concerned in the potential supply for which consent had been refused; (*b*) the price which the Gas Company were required to pay for coke oven gas; (*c*) the price which the Gas Company charged for gas to existing consumers in circumstances similar to those obtaining in the case of the supply for which consent had been refused; and (*d*) the ownership and control of the parties seeking the consent and the geographical situation of their works in relation to one another and to the existing and projected mains of the Company.

An existing agreement with the Yorkshire Electric Power Company concerning the supply of coke oven gas was to be preserved.

Investors' Gas and Electric Trust.

Investors' Gas and Electric Trust, which has been formed by interests associated with Dawnay, Day, & Co., Ltd., the merchant bankers, offers an investment—planned according to the well-known fixed trust principle—in 14 leading companies in the Gas and Electrical industries. The yield offered is £4 6s. 10d.% at the current price of 14s. 6d. per sub-unit, without taking into account any new issue or bonus rights, which, on an average, have been worth an additional ¾% per annum over the past five years. As in the case of Investors' General Fixed Trust, which was sponsored by the same interests, the Trustees are Royal Exchange Assurance, and the bankers to the Trustees are Barclays Bank, Ltd.

The specific attraction of the new trust claimed by its sponsors is that it gives the investor an opportunity of spreading his capital in a convenient way over a field of enterprise noted for its stability, its ability to withstand adverse conditions, and its great scope for further expansion, while offering a very fair and assured income yield.

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The activity in gold-mining shares was again the feature of Stock Exchange business last week. That the movement is a serious one is evidenced by the fact that only the stocks of the well-established companies are being purchased, and even banks and insurance houses are among the buyers. Elsewhere most markets have been dull, especially in the Industrial section, where the absence of speculative support, coupled with a small amount of liquidation, led to a marking down of prices.

There were no signs, however, of any curtailment of business in Gas stocks and shares. The market had a good "all-round" week, the recorded transactions covering a wider field than the previous period. Prices remained very steady, and, as will be seen in the Stock and Share List, the quotations of a few leading stocks were marked up. The only two falls occurred in the stocks of companies operating abroad.

At the time of writing there is still a plentiful supply of ordinary stocks on offer, but the debenture list is very small, the only parcel of note being that of £10,000 Gas Light 3% at 86. In the preference group several small parcels of stock which are not usually readily obtainable have come into the market, including £310 British 7% cumulative at 158 yielding £4 8s. 7d.%, and £50 Mid Southern Utility 4% at par. A parcel of £249 South Midland Gas Corporation 4½% cumulative preference is offered at 21s. 6d., yielding £4 3s. 6d.%, the first dividend accruing from the date of issue. This stock is redeemable in 1984 at par, or after 1974 at 20s. 6d., and the yield, allowing for redemption, works out at £4 2s. 6d. There is also £155 Tottenham 5½% preference at 130, yielding £4 4s. 6d.%, while £170 York 4%, referred to last week, still remains unsold.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *June* 11.

There is no change to report in the tar products market, and current prices remain at about the following levels:

Pitch, 57s. 6d. per ton f.o.b.

Creosote, 3¾d. to 4d. per gallon.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, 2s. 6d. to 2s. 7d.; pure benzole, 1s. 9d. to 1s. 10d.; 95/160 solvent naphtha, 1s. 8d. to 1s. 9d.; and 90/160 pyridine, 6s. 6d. to 7s.—all per gallon naked at makers' works.

Tar Products in the Provinces.

June 11.

The average prices of gas-works products during the week were: Gas-works tar, 24s. to 29s. Pitch—East Coast, 55s. to 57s. 6d. f.o.b. West Coast—Manchester Liverpool, Clyde, 55s. to 57s. 6d.* Toluole, naked, North, 2s. 0½d. to 2s. 2½d. Coal-tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, North, 10d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 3d. to 3¼d.; low gravity, 3⅜d. to 3⅝d.; Scotland, 2⅝d. to 3¼d. Heavy oils, in bulk, North, 3⅜d. to 4¼d. Carbolic acid, 60's, 2s. to 2s. 1½d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *June* 9.

Trading has been on a restricted scale during the week, but prices of most products are well maintained.

Crude gas-works tar.—The actual value is 35s. to 37s. per ton *ex* works.

Pitch.—The local distillers are firmer in their attitude, but no change in value has taken place. The export price is round 45s. to 47s. 6d. per ton, f.o.b. Glasgow, while, in the home market, small quantities are leaving the works at 42s. 6d. to 45s. per ton *ex* works.

Refined tar.—Large quantities are leaving the works and value is steady at 3⅜d. to 3¼d. per gallon *ex* works naked, according to quantity.

Creosote oil.—Prices are well held and prompt supplies are still scarce. B.E.S.A. specification oil is 4d. to 4¼d. per gallon; low gravity, 4½d. to 4⅝d. per gallon; and neutral oil, 4¼d. to 4½d. per gallon—all f.o.r. in bulk.

Cresylic acid.—A small but steady business is being conducted at round the following prices: Pale, 97/99%, is 1s. 2½d. to 1s. 3½d. per gallon; dark, 97/99%, 1s. to 1s. 1d. per gallon; and pale, 99/100%, 1s. 4d. to 1s. 5d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha continues to command 4¾d. to 5¼d. per gallon, according to quality and quantity.

Solvent naphtha.—90/160 grade is 1s. 4d. to 1s. 4½d. per gallon, and 90/190 grade is 8d. to 8½d. per gallon.

Motor benzole is particularly scarce and available supplies are quoted at 1s. 6d. to 1s. 7d. per gallon.

Pyridines.—90/160 grade is 5s. to 5s. 3d. per gallon, and 90/140 grade 5s. 6d. to 6s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole . . .	0	9	to	0	9½	per gallon at works
Motor ,, . . .	1	3½	,,	1	4	,, ,, ,,
90% ,, . . .	1	4	,,	1	4½	,, ,, ,,
Pure ,, . . .	1	7½	,,	1	8	,, ,, ,,

Contracts Advertised To-Day.

Coal.

Mountain Ash Urban District Council. [p. 822.]
Silsden Gas Department. [p. 823.]
Sowerby Bridge Urban District Council. [p. 822.]
Stratford-on-Avon Gas Department. [p. 823.]
Sutton-in-Ashfield Gas Committee. [p. 823.]

Coke Grading and Storage Plant.

Hoylake Gas Department. [p. 823.]

Haulage of Coal.

Sowerby Bridge Urban District Council. [p. 822.]

Mantles.

Sutton-in-Ashfield Gas Committee. [p. 823.]

Oil (Lubricating).

Sutton-in-Ashfield Gas Committee. [p. 823.]

Retorts.

Newport (Salop) Gas Department. [p. 822.]

Tubes and Fittings.

Sutton-in-Ashfield Gas Committee. [p. 823.]

New Capital Issues.

Weston-super-Mare and District Gas Company.—The recent issue by this Company of £17,828 4% debenture and £1,203 consolidated ordinary stock was largely over-subscribed and realized an average price of £102 13s. 3d. and £113 16s. 9d. respectively. The lowest tender accepted for the debenture stock was £102 1s. 6d.% and the highest £105%. The consolidated ordinary stock was accepted at £116 10s. 6d.%.

Gas Acts (1920 and 1929) Orders.

Solihull Gas Company.

The Company are to apply for an Order to enable them to acquire the undertaking of the Knowle and District Gas Company, Ltd.

Danish Gas Company.—The offices of Det Danske Gaskompagni, it is announced, will be, as from June 11, 13-14, Dartmouth Street, S.W. 1. Telephone: Victoria 4267.

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THEORY OF INDUSTRIAL GAS HEATING

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STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. June 8.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Apl. 9	7	7	Alliance & Dublin Ord. ...	128—138	...	135⅝—135½
374,000	"	Jan. 8	4	4	Do. 4 p c. Deb. ...	90—100	...	...
557,655	"	Mar. 5	7	7	Barnet Ord. 7 p.c.	167—172	...	...
300,000	1	May 7	1/4⅜	1/9⅜	Bombay, Ltd.	27/6—29/6	+1/-	27/3—29/6
178,480	Stk.	Feb. 19	9½	9½	Bournemouth sliding scale	203—208	...	...
550,050	"	"	7	7	Do. 7 p.c. max. ...	165—170	...	166—168½
439,160	"	"	6	6	Do. 6 p.c. Pref. ...	142—147	...	...
50,000	"	Dec. 18	3	3	Do. 3 p.c. Deb. ...	79—84	...	...
262,025	"	"	4	4	Do. 4 p.c. Deb. ...	105—110	...	109½
335,000	"	"	5	5	Do. 5 p.c. Deb. ...	121—126	...	...
357,900	"	Mar. 5	7½	7½	Brighton, &c., 6 p.c. Con. ...	161—166	...	...
540,000	"	"	6⅔	6⅔	Do. 5 p.c. Con. ...	151—156	...	154—155
195,500	"	"	6	6	Do. 6 p.c. B. Pref.	140—145	...	...
1,457,500	"	Mar. 5	5	5	Bristol 5 p.c. max.	116—117*a*	...	...
190,490	"	Dec. 18	4	4	Do. 1st 4 p.c. Deb. ...	104—106*a*	...	...
217,870	"	"	4	4	Do. 2nd 4 p.c. Deb. ...	104—106*a*	...	...
328,790	"	"	5	5	Do. 5 p.c. Deb.	123—125*a*	...	...
885,000	"	Apl. 9	7	8	British Ord.	155—160	...	158½—160
100,000	"	Dec. 18	7	7	Do. 7 p c. Pref.	153—158	...	...
350,000	"	"	5½	5½	Do. 5½ p.c. Pref.	106—111	...	...
120,000	"	"	4	4	Do. 4 p.c. Red. Deb. ...	97—102	...	...
450,000	"	"	5	5	Do. 5 p.c. Red. Deb. ...	109—114	...	...
160,000	"	Jan. 8	5	5	Cambridge 5 p.c. Deb. ...	115—120	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1½—3½	...	...
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	5—7	...	...
150,000	Stk.	Dec. 18	4½	4½	Do. 4½ p.c. Deb. ...	95—100	...	...
626,860	"	Feb. 19	6	6	Cardiff Con. Ord.	128—133	...	131½—132½
237,860	"	Jan. 8	5	5	Do. 5 p.c. Red. Deb.	103—108	...	...
157,150	"	Feb. 19	5	6½	Chester 5 p.c. Ord.	112½—122½*b*	...	...
98,936	1	May 7	2/-	2/-	Colombo, Ltd. Ord.	1 7/8—1 11/16	...	...
24,500	1	"	1/4⅜	1/4⅜	Do. 7 p.c. Pref. ...	18/6 - 20/6	...	...
609,204	1	Mar. 19	-/11'48	-/11'48	Colonial Gas Assn. Ltd. Ord.	19/6—21/6	—/9	20/7½—20/10½
296,053	1	"	1/8'80	1/8'80	Do. 8 p.c. Pref.	23/6—25/6	...	...
1,775,005	Stk.	Feb. 19	5	6½	Commercial Ord.	120—126	...	120½—122½
475,000	"	Dec. 18	3	3	Do. 3 p.c. Deb. ...	77—82	...	...
286,344	"	Mar. 5	5	5	Do. 5 p.c. Deb. ...	120—125	...	...
807,560	"	Feb. 19	7	7	Croydon sliding scale ...	154—159	...	155—157
569,590	"	"	5	5	Do. max. div.	105—110	...	109—110
620,385	"	Jan. 8	5	5	Do. 5 p.c. Deb.... ...	121—126	...	...
542,270	"	Mar. 5	7	10	Derby Con.	175—180*a*	...	...
55,000	"	Jan. 8	4	4	Do. 4 p.c. Deb.	98—100*a*	...	...
209,000	"	Feb. 19	5	5	East Hull Ord. 5 p.c. ...	106—111	...	106½
181,625	"	Mar. 5	6	6	East Surrey Ord. 5 p.c. ...	126—131	...	...
175,609	"	Dec. 18	5	5	Do. 5 p.c. Deb. ...	118—123	...	...
1,092,180	"	Apl. 9	†5	†7	European, Ltd.	122—127	+1	122½—123½
19,349,763	"	Feb. 19	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	26/10½—27/4½*f*	...	26/10½—27/3
2,600,000	"	"	3½	3½	Do. 3½ p.c. max.	87—90	...	87½—88½
4,477,106	"	"	4	4	Do. 4 p.c. Con. Pref. ...	103—106	...	104½—105½
6,102,497	"	May 28	3	3	Do. 3 p.c. Con. Deb. ...	84—87*	...	84½—85½
3,642,770	"	"	5	5	Do. 5 p.c. Red. Deb. ...	115—118*	...	116½—117
3,500,000	"	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	113—116*	...	118½—115
270,466	"	Mar. 5	6	6	Harrogate New Cons. ...	125—130	...	...
82,500	"	Mar. 5	7	7	Hastings & St. L. 5 p.c. Conv.	147—152	...	...
258,740	"	"	5½	5½	Do. 3½ p.c. Conv	115—120	...	...
140,000	1	Apl. 23	1/7½	1/7½	Hongkong & China, Ltd. ...	1⅝—1⅞	...	...
218,200	Stk.	Mar. 5	6	6	Hornsey Con. 3½ p.c. ...	128—133	...	...
5,600,000	"	May 28	10	14	Imperial Continental Cap.	207—212*	−2	207—210½
228,130	"	Feb. 5	3½	3½	Do. 3½ p.c. Red. Deb.	89—94	...	...
235,342	"	Mar. 5	8½	8½	Lea Bridge 5 p.c. Ord. ...	169—174	...	...
2,167,410	"	Mar. 5	6	6	Liverpool 5 p.c. Ord. ...	130—132*b*	...	...
245,500	"	Dec. 18	5	5	Do 5 p.c. Red. Pref. ...	101—111*b*	...	...
306,083	"	July 17	4	4	Do. 4 p.c. Deb. ...	101½—103½*b*	...	...
165,786	"	Feb. 19	8	10	Maidstone 5 p.c. Cap. ...	180—190	...	180
56,176	"	Jan. 8	3	3	Do. 3 p.c. Deb. ...	72—77	...	...
75,000	£	May 28	†10	†10	Malta & Mediterranean ...	9 - 11*	...	£10/8/-£10/9/-
392,000	—	Apl. 3	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98 103	...	...
231,978	Stk.	Feb. 19	5	5	M. S. Utility "C." Cons. ...	113—118	...	115—116
818,657	"	"	4	4	Do. 4 p.c. Cons. Pref.	95 - 100	...	97½
360,075	"	Jan. 8	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
148,955	"	"	5	†5	Do. 5 p.c. Deb. ...	117—122	...	...
675,000	"	May 28	†6	†13	Montevideo, Ltd.	60 - 65*	...	63
2,061,315	"	Mar. 5	5	5½	Newcastle & Gateshead Con.	25/— 25/9 *f*	+/-/1½	...
682,856	"	"	4	4	Do. 4 p.c. Pref. ...	99 —101*d*	...	...
776,706	"	Jan. 8	3½	3½	Do. 3½ p.c. Deb. ...	92—93*d*	...	...
277,285	"	May 7	5	5	Do. 5 p.c. Deb. '43 ...	103—107*d*	...	...
274,000	"	Feb. 19	5	5	Newport (Mon.) 5 p.c. max.	106—108*a*	...	...
204,940	"	Mar. 19	7½	7½	North Middlesex 6 p.c. Con.	155—160	...	...
393,160	"	Feb. 5	5	5	Northampton 5 p.c. max. ...	100—105	...	...
300,000	"	May 7	†9	†7	Oriental, Ltd.	155—160	...	159½
316,617	"	Dec. 18	8	8	Plym'th & Stonehouse 5 p.c.	167—172	...	171½
504,416	"	Feb. 19	8	8	Portsm'th Con. Stk. 4 p.c. Std	168—173	...	171—172½
241,446	"	"	5	5	Do. 5 p.c. max. ...	105—110	...	107½—107½
114,000	"	Feb. 19	5	5	Preston 5 p.c. Pref.	103—108	...	...
686,312	"	Jan. 22	4	4	Primitiva 4 p.c. Rd. Db. 1911	87—92	...	...
389,813	"	Dec. 18	4	4	Do. 4 p.c. Cons. Deb.	88—93	...	92½
150,000	10	Mar. 19	6	6	San Paulo 6 p.c. Pref. ...	7—8	...	...
1,736,968	Stk.	Mar. 19	6	6	Sheffield Cons.	137—139*c*	...	...
95,000	"	Jan. 8	4	4	Do. 4 p.c. Deb.	98 102*c*	...	...
133,201	"	Feb. 19	8½	5	Shrewsbury 5 p.c. Ord. ...	135—140	...	...
90,000	10	May 28	‡4	‡3	South African	2—4*	...	...
6,709,895	Stk.	Feb. 19	5	7	South Met. Ord.	132—135	+1	132½—134½
1,135,812	"	"	6	6	Do. 6 p c. Irred. Pf.	140—145	...	145
850,000	"	"	4	4	Do. 4 p.c. Irred. Pf.	103—107	...	106
1,895,445	"	Jan. 8	3	3	Do. 3 p.c. Deb ...	84—87	...	86½
1 000,000	"	Jan. 22	5	5	Do. 5 p.c. Red. Deb.	114—117	...	...
209,820	"	Mar. 5	6½	6½	South Shields Con.	165—167*d*	...	...
1,543,795	"	Feb. 19	6	6	South Suburban Ord. 5 p.c.	130—133	...	130½—132
512,825	"	"	5	5	Do. 5 p.c. Pref.	118—123	...	120 —122
300,000	"	"	—	4	Do. 4 p.c. Pref.	103—108	...	103½
868,837	"	Dec. 18	5	5	Do. 5 p.c. Deb.	121—126	...	...
100,000	"	"	4	4	Do. 4 p c. Deb.	103—108	...	106½
647,740	"	Mar. 5	5	5	Southampt'n Ord. 5 p.c. max.	109—114	...	...
121,275	"	Dec. 18	4	4	Do. 4 p.c. Deb.	100—105	...	...
350,000	"	Mar. 5	5½	5½	Swansea 5½ p.c. Red. Pref.	106—111	...	...
200,000	"	Dec. 18	6½	6½	Do. 6½ p.c. Red. Deb.	103—108	...	...
1,076,490	"	Mar 5	6⅔	6⅔	Tottenham and District Ord.	149—154	+1	153—154
409,835	"	"	5½	5½	Do. 5½ p.c. Pref. ...	126—131	...	127—131
62,235	"	"	5	5	Do. 5 p.c. Pref. ...	112—117	...	115
199,005	"	Dec. 18	4	4	Do. 4 p.c. Deb. ...	97—102	...	...
85,701	"	Apl. 9	6	6	Tuscan, Ltd. 6 p c. Red. Db.	90—100	...	...
349,110	"	Mar. 5	7	7	Uxbridge, &c., 6 p.c. ...	150—155	...	...
88,330	"	"	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
1,322,220	"	Mar. 5	7	7	Wandsworth Consolidated	156—161	...	159—161
1,096,378	"	"	5	5	Do. 5 p.c. Pref.	119—124	...	124
1,317,964	"	Dec. 18	5	5	Do. 5 p.c. Deb.	122—127	...	...
158,400	"	Mar. 5	5	6*g*	Winchester W.& G.5 p.c.Con.	115—120	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g.*—Paid £3, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year.

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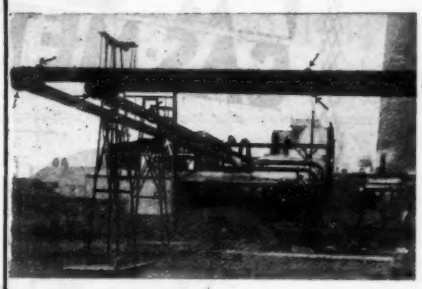
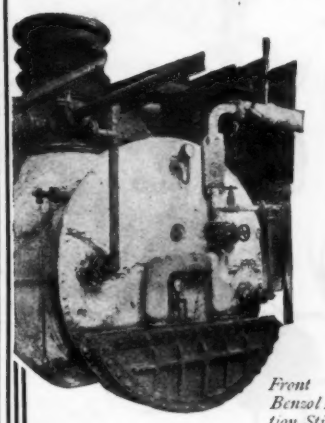


Two Steam Mains, one at a Pressure of 170 lbs. per square inch, the other at 20 lbs. per square inch.



Front View of Benzol Rectification Still. Pressure on Steam Chest, about 80 lbs.

These photographs show part of a Coke Oven Plant in a large Gas Works. Here again, "Permac" metal-to-metal jointing material has succeeded when more expensive jointings have failed.

"Permac" stands up to the highest temperatures and pressures. It is equally successful on all kinds of joints—steam, water, gas, oil. Send for a trial tin and test it on your most difficult job. You are certain of success

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METAL-TO-METAL JOINTING MATERIAL.

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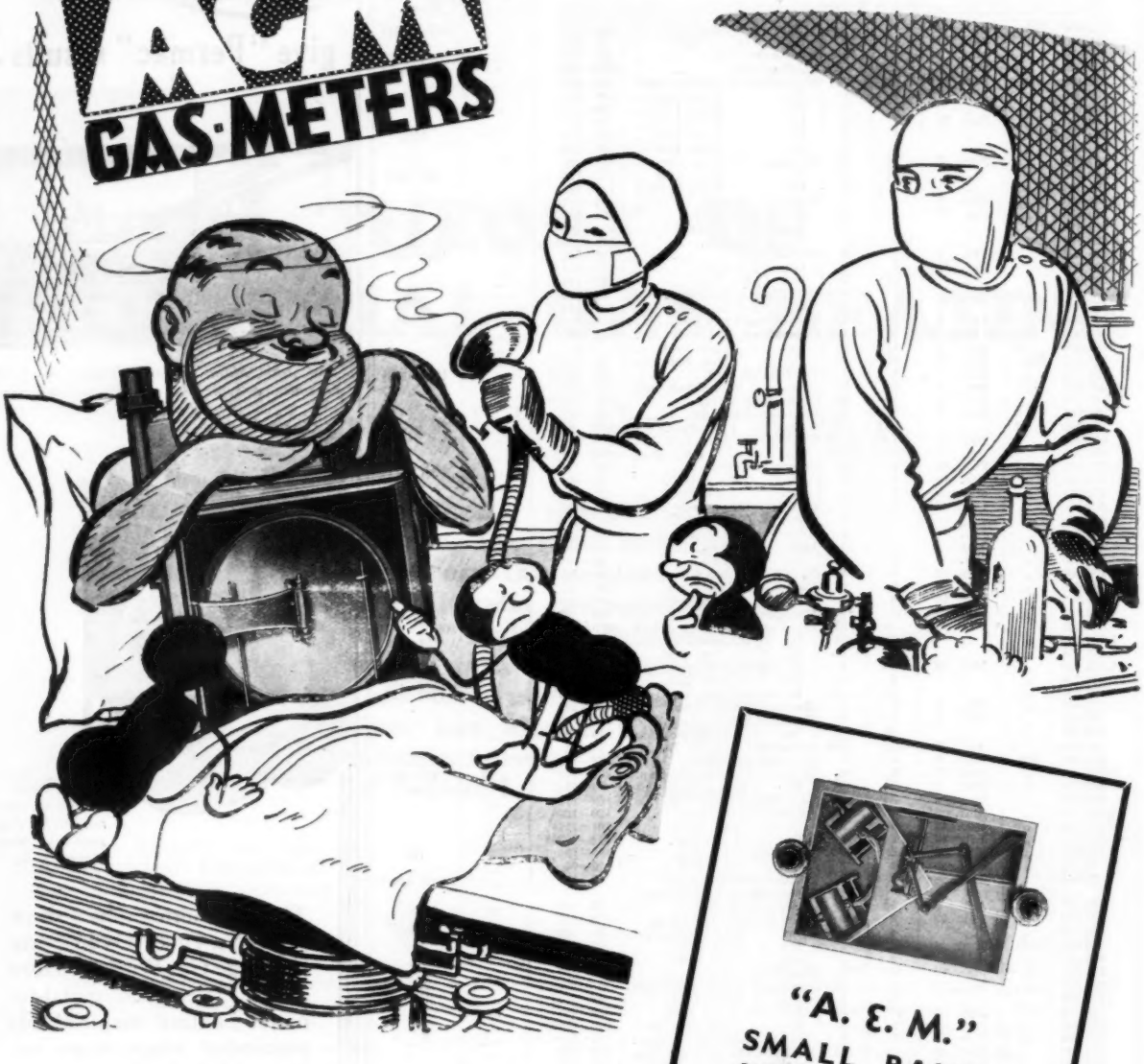
A E M GAS METERS

TRAIN THE THERMS



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Here's "a case"—a splendid case! (*Baldwins Staffordshire Plate*). Magnificent lungs (*Selected Persian Skins*). The valves of the heart, large and orthodox! Arteries clear and of generous dimensions! There's "stuffing" in **these** glands! No malingerer this!! Trust Sergt. A. E. M. Meters to tally YOUR Therms!

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